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DISCUSSION PAPER SERIES

IZA DP No. 17085

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ABSTRACT

Posh Spice or Scary Spice? Resource Booms, Wealth, and Human Capital across Ages*

We examine the impact of a six-fold increase in the global vanilla price on smallholder vanilla-farming households in Madagascar. The price increase leads to sizable gains in household assets and significant improvements in adult psychological well-being, cognitive performance, and optimism about the economy. In contrast, we find no significant effects on children's health or schooling. Given substantial evidence from the literature that improvements in household economic resources can have large effects on children over the long run, the lack of shorterterm effects in this setting may reflect the time-varying nature of the impact or the need for additional complementary investments.

JEL Classification: O12, O13, I15, I31, Q12

Keywords: export commodities, agriculture, human capital, crime

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For many rural households in developing countries, off-farm labor market opportunities are limited, and the cultivation of cash crops provides one of the few pathways to expand their incomes beyond subsistence farming. As households increase their participation in cash crop production, their livelihoods become more closely connected to output markets, and changes in crop prices can have large impacts on their incomes. These changes in income can also affect other dimensions of well-being, such as health and education.

To shed light on the relationship between commodity prices and the well-being of agricultural households, we study a historically large and persistent increase in the price of vanilla. From 2015-2018, the global price of vanilla increased more than six-fold. We analyze the impacts of this price change on vanilla farmers and their children in Madagascar, which produces and exports around 80 per cent of the world's vanilla crop. We first look at the extent to which the increase in international prices leads to changes in the wealth of smallholder households. Then we examine the effects on several dimensions of human capital, including the psychological well-being and cognitive skills of adults, as well as the health and education of children. By studying the effects on these other outcomes, we can gain insight into the broader question of the relationship between household economic circumstances and individual human capital. Our findings also help us learn about the prospects for rural households to benefit from the production of high-value crops, which has implications for policies aimed at promoting the production of export crops.

Although we might generally expect that higher world market prices will lead to higher incomes for producers, positive impacts may be limited or accompanied by important trade-offs[1]—particularly in a setting like Madagascar,

[1] The existing evidence from other contexts is mixed: Beck et al. (2018) and Adhvaryu et al. (2019b) find that international coffee price changes are transmitted to producer house-

which is one of the poorest countries in the world, with 80.7 per cent of the population living in extreme poverty in 2012.[2] Given the low level of market integration and limited access to information among small and isolated farmers living in remote regions that produce vanilla, middlemen or other vanilla buyers may have substantial market power, which they can use to drive down the prices paid to farmers, and which could influence the pass-through of increases in the world price.[3] Although the evidence in this regard in Madagascar is limited, industry observers report that farmers may receive only 5 to 10 per cent of the export value of their crop (Financial Times, 2018).

Even if the price increase does result in positive income shocks for smallholder producers, the expected impacts on other aspects of well-being are ambiguous. We might expect higher income to lead to improvements in psychological well-being for adults. Yet while some studies of cash transfer programs have documented positive impacts on mental health and other aspects of psychological well-being, the range of estimates across studies is large, and other studies find tightly-estimated null effects.[4] Beyond the cash transfer

holds in Vietnam and Tanzania, respectively, while Angrist and Kugler (2008) find only modest economic benefits in coca producing regions in Colombia.

[2]As measured with the international poverty line of USD 2.15 per capita consumption (in 2017 PPP); see World Bank (2023b).

[3]This situation has been observed elsewhere. In Guinea-Bissau, farm-gate prices of cashew nuts are a result of oligopsonistic competition, given a market concentration of traders who buy the cashew at the farm-gate, relative to a large number of smallholder cashew farmers (Cont and Porto, 2014), and in Côte d'Ivoire, much of the wealth from cocoa production has accrued to corrupt officials and the highly concentrated corporate sector (Merckaert, 2022).

[4]For example, Haushofer and Shapiro (2016) find large positive effects on psychological well-being resulting from unconditional cash transfers to poor households in Kenya; Hidrobo et al. (2020) find positive impacts of cash transfers in Mali on some areas of psychological well-being, but no impacts on cognition, while Bossuroy et al. (2022) find that economic transfers improved both economic outcomes as well as mental health, and combining these interventions with skill-building and psychosocial interventions increased the effect, in line with findings by Banerjee et al. (2015) on multi-faceted poverty graduation programs. See Romero et al. (2021) for a review and meta-analysis of this literature. Zimmerman et al. (2021) review the literature on the mental health effects of cash transfers specifically for

literature, the evidence from other settings is more limited.[5] In our specific context, there may even be reason to expect a negative effect on psychological well-being if, as suggested by several media reports, the resource windfall leads to increases in local crime or instability (BBC, 2019; O'Reilly, 2018).

The expected effects on children's human capital are even more ambiguous. The income effect from higher crop revenues should increase investments in children's human capital, all else equal. But this effect may be offset by a substitution effect or "opportunity cost channel," where the higher returns to cash crop production raise the opportunity cost of time-related parental investments in children's health (Miller and Urdinola, 2010) or education (Atkin, 2016; Carrillo, 2020; Uribe-Castro, 2021). The empirical findings from the literature offer mixed results in this regard, with some studies finding that increased returns to income-generating activities result in negative effects on children's health, nutrition, and education, while others find the opposite.[6]

To examine the different ways that a commodity price change affects the living standards of producers and producing communities, we exploit the rapid increase in the price of vanilla from less than USD 100 per kg in 2015 up to a record high in 2018 of USD 600—a unit price comparable to that of silver.

young people (aged 0-24) in low- and middle-income countries (in contrast to Romero et al. 2021, who also include estimates for adults and from advanced economies). While most of the studies analyzed by Zimmerman et al. (2021) find positive effects on some mental health outcomes, there is substantial heterogeneity across studies in the size of the effect as well as which outcomes are affected. And for depressive symptoms in particular, their meta-analysis finds no statistically significant effect.

[5]Andersen et al. (2022) find that winning a housing lottery in Ethiopia has zero effects on adults' psychological distress, but they do find increases in overall life satisfaction. Cesarini et al. (2016) find no effects on adult mental health from lottery wins in Sweden.

[6]See Ferreira and Schady (2009) for a discussion of the literature examining the effects of economic shocks on children's human capital. Beck et al. (2018) provide more recent evidence related to the effects of commodity prices changes in Vietnam. And Charris et al. (2024) provide further evidence regarding the income and substitution effects of income shocks caused by tariff reductions in Brazil.

To identify the impacts, we combine information on the timing of the price change with variation in vanilla production across households and regions. Several features of this setting assist with our empirical identification. While Madagascar is the largest vanilla producer in the world, individual farmers producing vanilla operate on a small scale, with little opportunity to influence the price. The increase in price appears to be largely due to increased demand for natural vanilla on the part of global consumers (Steavenson, 2019), reflected in Nestlé USA's decision in 2015 to only use all-natural vanilla in its products (Nestlé, 2015; Reel, 2019), combined with the relatively inelastic supply of vanilla.[7] Since the time between planting and harvesting can take up to four years, farmers cannot quickly adjust output in response to price fluctuations, and households that adopt vanilla in response to the price change would not see benefits for several years.

We use several datasets in our work that straddle the price shock. Most important is a large panel survey, in which we collected a wide range of information since 2003 on over 1400 individuals who were around 30 years of age in 2019. These data include information about vanilla production at the household level. Using a differences-in-differences design, we compare outcomes over time for vanilla producers and non-vanilla producers in terms of wealth, savings behavior, psychological well-being, cognition, and work.

In addition to this household-level panel, we also use data from several nationally-representative household surveys conducted before and after the price increase. Unlike our panel, these surveys lack household-specific information on vanilla production. We therefore combine these datasets with infor-

[7] The supply was further constrained by a cyclone that hit part of the vanilla-growing region in 2017. In Section 5.1, we estimate alternative specifications accounting for the exposure to the cyclone using geocoded information of its track.

mation on vanilla production at the community level and compare households living in vanilla-producing areas to those in other regions. These surveys include information related to wealth, access to health services, and perceptions of economic well-being, along with (limited) information on child health and education. For those outcomes which are common to both our panel data set and the repeated cross sectional surveys, such as wealth, our results are broadly consistent despite the differences in data sources and identifying assumptions, bolstering confidence in our findings.

Our main results are as follows. We first demonstrate that the increase in vanilla prices led to substantial increases in wealth among vanilla-producing households and in vanilla-producing regions. Using an asset index, we observe a relative increase in average wealth of vanilla farmers ranging from 0.45 to 0.83 standard deviations. Vanilla farmers reported median annual vanilla revenue of USD 7,131.60 in 2019 (PPP-adjusted), a value equivalent to roughly 2.6 times the annual consumption expenditure of a household that lives just at the international poverty line. Given that 80.7 per cent of the population lives below this poverty line, the vanilla revenue places households among the relatively wealthy.[8] We likewise observe a large shift in the vanilla region's overall wealth distribution relative to the rest of the country. While the rural wealth distribution was initially similar across these areas, after the shock, 76 per cent of households in the vanilla region had wealth levels above the national median.

Beyond these economic outcomes, we also find improvements in vanilla farmers' psychological well-being and cognition. Using a measure of the personality trait "emotional stability" as a proxy for psychological well-being,

[8]Based on our average household size of 3.1 members, the per-person vanilla revenue corresponds to roughly 1.6 times the level of GDP per capita in 2019 (in 2017 PPP).

we find a relative increase in psychological well-being of around 0.4 standard deviations.[9] The absolute magnitudes of our estimated impacts are large relative to the existing literature, but the magnitude of the income shock is also unusually large; if we scale the effect by the size of the income shock, our effect sizes are broadly in line with the findings from the literature on economic transfers.[10] This increase in psychological well-being is in line with our findings using nationally-representative household surveys that show people in vanilla-producing communities report a relative increase in satisfaction with their living conditions and greater optimism about the economic conditions of the country. We additionally measure cognitive performance, using math and French tests, and find a relative increase in the math score for vanilla farmers of around 0.3 standard deviations, but no statistically significant effect on the French score.

Although we find several improvements in adult economic outcomes and well-being, we do not find any evidence of improvement in human capital outcomes among children. Children in vanilla communities do not have better health status at birth or afterward compared to children in non-vanilla com-

[9]Emotional stability is the name given to one of the "big five" personality traits, and has been shown to be strongly correlated with subjective well-being, life satisfaction, and happiness (DeNeve and Cooper, 1998; Hills and Argyle, 2001; Winzer et al., 2021). This trait is alternatively known as *neuroticism*, in which case the values take the opposite sign (thus representing a measure of emotional *in*stability). To measure the emotional stability of our cohort members (as part of a questionnaire designed to capture noncognitive or personality traits), we asked their agreement with a series of 19 statements, such as "I am often worried" or "I get frustrated easily."

[10]In their review of the literature on the impact of economic transfers, Romero et al. (2021) report an average effect on psychological well-being of 0.1 standard deviations across all intervention types, while our estimated impacts on psychological well-being range from 0.36 to 0.45 standard deviations. The annual revenue of vanilla (USD 7,131 in 2019 PPP) is also higher than the economic transfers in most RCTs, where the median economic transfer is equivalent to USD 540 PPP globally. In low- and middle-income countries, there is large variation in transfer sizes ranging from USD 25 PPP in Malawi (Ohrnberger et al., 2020) to USD 6,475 PPP in a multifaceted poverty graduation program across six countries (Banerjee et al., 2015).

munities, which is remarkable given the low health status of children in the country, with 42 per cent of children being stunted in 2018 (INSTAT, 2019).[11] We see no effect on educational attainment for young women in vanilla communities relative to other rural parts of the country. As a possible explanation for why the increases in wealth do not translate into child health improvements, we look for evidence that positive wealth effects could be offset by reductions in parental investment—particularly parental time investments in children—but we find no evidence that this "opportunity cost channel" plays an important role.[12] We also expected greater wealth to increase access to and use of public services that are important inputs to child health. But here too there is no significant change in the use of antenatal care services, and no relative improvement in household access to safer sanitation and drinking water. Given the important role that these public services play in preventing childhood illnesses, the lack of any impact here may help explain our finding that the positive shock does not contribute to improvements in child well-being.

Our paper contributes to several strands of the large literature examining the effects of income shocks and household economic resources on human capital. First, our results add to the literature examining the contemporaneous effects on mental health and psychological well-being. Our setting stands out due to the nature of the income shock: the income gains are unusually large, relatively persistent, and driven by agricultural commodity price fluctuations as opposed to policy interventions. Yet our estimated effects on the

[11] This indicator of chronic malnutrition is measured by height-for-age being below 2 standard deviations from the reference mean.

[12] If anything, in our context, we might expect to see *improvements* in parental time investment, given our other findings for adults. Specifically, we find no increase in hours worked along with a reduction in time spent on household chores, potentially allowing parents to spend more time with children; we also find increases in emotional stability and cognition, which could potentially increase the quality of these time investments.

psychological well-being of adults are broadly consistent with the findings from evaluations of economic transfer programs, suggesting that the estimates from those studies may apply to income changes outside the context of transfer policies.

We also contribute to the large subset of this literature specifically focused on children's human capital in developing countries.[13] In contrast to our positive estimates for adults psychological well-being and cognition, we generally find no effects on children's human capital. The lack of evidence for a negative "opportunity cost channel" is potentially consistent with the windfall nature of our income shock: in the short- to medium-term, producers benefit from higher farm-gate prices with little change in outside labor market opportunities, and thus the scope for negative substitution effects is small. Together with the lack of any significant overall impact on children, our findings suggest that the *income effects* on child health and education in our context are also small or zero, at least over the short- to medium-term.[14] This interpretation is also consistent with the related evidence from randomized controlled trials of unconditional transfers: while these transfers generally do not result in the negative effects on children's human capital observed in other contexts, the

[13]In addition to the literature on commodity price fluctuations (Adhvaryu et al., 2019a,b; Beck et al., 2018; Carrillo, 2020; Cogneau and Jedwab, 2012; Kruger, 2007; Miller and Urdinola, 2010; Uribe-Castro, 2021; Kebede, 2021; Mekasha et al., 2022), the sources of economic shocks that have been studied are varied and include weather shocks, macroeconomic fluctuations, conflict, and changes in trade policy, as well as plant openings. Because these shocks can influence not only household income, but many variables simultaneously, including factor prices, agricultural input and technology use, and local services, there can be multiple channels of impact that can be difficult to disentangle. Furthermore, recent evidence suggests that the effects of these income shocks may vary depending on what part of childhood children are exposed (Beshir and Maystadt, forthcoming; Carneiro et al., 2021).

[14]To the extent that this is true in other settings, it helps explain the prevalence of studies that find negative overall effects (Atkin, 2016; Carrillo, 2020; Miller and Urdinola, 2010; Uribe-Castro, 2021): if the income effect is small, only a moderately-sized substitution effect is required to turn the overall impact negative.

positive effects on these outcomes are also generally modest.[15]

Another contribution of our paper is the ability to examine the short- to medium-run effects across multiple outcomes for both adults and children, thereby complementing the literature on long-run effects. Understanding the dynamic effects of income shocks over time is critically important for assessing the relative costs and benefits of policies. A large and growing body of literature has consistently found long-run effects of income shocks, particularly when it comes to the critical period around birth and the first years of a child's life (Almond and Currie, 2011; Almond et al., 2018; Barr et al., 2022).[16] Because much of this literature relies on matching historical shocks to more recent data, we often know little about the contemporaneous effects. In our setting, while we see no impact on human capital outcomes for children, we do observe sizable effects on household resources and parental well-being—two factors that have been shown to affect child outcomes over the long run. Considered in the context of the existing literature, our findings suggest that we should be cautious when interpreting the short-run effects of economic shocks on children's health and education: the presence of null (or even negative) results on specific human capital outcomes does not preclude substantial positive effects over the long run.[17]

The remainder of the paper is structured as follows. The next section provides a brief discussion of the vanilla production process and the explanation for the price surge (Section 1). We then describe the data sets used (Section

[15]See Bastagli et al. (2019) for a summary of the near-term evidence from RCTs, which show modest effects of cash transfers on children's skills and height and weight.

[16]East et al. (2023) find that these effects persist even in the next generation.

[17]This is in line with the concept of time-complementarity of investments in children's human capital, whereby investments in early childhood are not productive if they are not followed up by later investments, and whereby early investment facilitates the productivity of later investment (Cunha et al., 2006; Cunha and Heckman, 2007).

2) and our empirical specifications (Section 3), followed by a discussion of the main empirical results (Section 4) and robustness checks (Section 5). Section 6 concludes.

1 Vanilla production in Madagascar

Vanilla cultivation requires specific agroecological characteristics to be viable as a cash crop.[18] This limits opportunities for vanilla production around the world and helps explain why Madagascar is the world's largest producer of vanilla with an 80 per cent global market share (O'Reilly, 2018).[19] Within Madagascar, vanilla is only produced in the eastern coastal areas of the country, particularly in the northeastern region of Sava, with a small amount of production also in the Southeast. Other regions of the country, such as the highland areas of central Madagascar, are not suitable for production, as vanilla is not adaptable to colder temperatures during winter months and at higher altitudes (Shriver, 2013). The map in Figure 1 shows the distribution of vanilla production in the country.

Vanilla producers in Madagascar are small-scale farmers, often in remote villages that are not accessible by roads. They are generally engaged in food crop production as well, both for subsistence and for sale. Of the vanilla farmers in our sample, 88 per cent also grow rice, 14 per cent also grow manioc, and just a small minority also grow other cash crops, namely cloves and peanuts.

[18]Several conditions need to be met, such as a temperatures of 20-23°C, evenly distributed annual precipitation of 1,500 mm or more with no extended periods of drought or heat, an altitude up to 600 meters above sea level, minimal winds, and soil pH value between 6 and 7 (Plant Village, 2022).

[19]Vanilla has been produced in Madagascar since the 19^{th} century. While the plant is native to Central America, it was introduced to Madagascar, Indonesia, and surrounding countries by the French.

The median farm size for vanilla producers is 1 hectare, larger than the average of 0.5 hectares of other farmers. The median vanilla farmer uses half of their land (0.5 hectares) for vanilla cultivation.

In addition to the specific agroecological conditions required for the plant's survival, another distinctive feature of vanilla production is the long interval between initial planting and first harvest. The time between planting and pollination is as long as three years, and from pollination it takes from seven to nine months to harvest. Given the close to 4-year time span between planting and harvest, vanilla producers can only slowly increase production when faced with increased demand (O'Reilly, 2018).

The production of vanilla also has little economies of scale, as every step in the production process—from planting to hand-pollination to pruning and weeding—is highly labor-intensive.[20] While in Central America the plant is pollinated by bees, in Madagascar and other regions of the world vanilla requires hand-pollination. Each individual flower blooms just one day of the year, and therefore the task of pollination is very time-sensitive. The pollination occurs between October and January, and the crop is harvested between June and August (Hansen et al., 2016). Between pollination and harvest, the plant requires pruning, fertilization, and disease management. The longer the vanilla is allowed to mature on the plant, the higher the concentration of vanillin and the higher the quality of the plant, which can also affect the market price.[21] The tasks related to the production (as well as the post-harvest

[20] Crop husbandry during the growing period requires 260 days of labor per hectare during the first year, with approximately 460 additional days of labor during the first 4-8 years in a plant's life before it reaches full maturity (Cadot et al., 2008).

[21] The vanilla plant is a vine that requires a host, such as trees, to attach to. It is grown either on a shady forest-like plot, or in a greenhouse, and due to its shallow roots, it can thrive in an intercropped farm. Given the increased tree and vegetative cover the vanilla plants require, it can bring benefits to the farm by protecting water, forests, and soil and thus preventing rice plots from soil erosion (Martin et al., 2022).

processing) are relatively light physical labor requiring intricate handiwork; there is little advantage of a specific gender or age at any part of the production process, and labor on vanilla farms has traditionally been supplied by household members, with little hired labor (Cadot et al., 2008).

The output of the harvest is the green vanilla beans. Most farmers (95 per cent) sell these directly to collectors at the farmgate (Shriver, 2013). Most collectors at farm gate are closely connected with a preparator, who cures the vanilla. The preparator sorts the beans according to quality before selling them to an exporter, who usually is responsible for the final post-harvest processing, which involves aging the vanilla.[22] The entire post-harvest process of curing and aging takes up to six months, and thus further contributes to the slow supply response to increased demand. Finally, the exporters contract with importers, who do the final packaging and sell the vanilla to wholesalers and retailers (Shriver, 2013).

Until 1993, the price of vanilla was determined centrally by Madagascar's Vanilla Marketing Board (VMB). The abolition of the VMB led to price fluctuations for producers as the prices were set in global markets (Cadot et al., 2008). Figure 2 illustrates the dramatic increase in vanilla prices after 2015. The export price of vanilla was as high as USD 400 per kg in 2018, with retail prices climbing to USD 600 per kilogram. This is a remarkable increase from price levels that were consistently below USD 50 per kilogram until the mid 2010s. In 2019 among our sample, the revenue from vanilla was over 20 times that of cloves, another cash crop spice produced in Madagascar. Vanilla

[22] This curing process involves wilting the vanilla by submersing the beans in hot water for several minutes, after which the wilted beans go through a process where they are dried in sun during the day and then stored in boxed wrapped in blankets at night until the beans acquire a deep brown color. For the aging process, the dried beans are placed into closed boxes wrapped in wax paper for up to six months while the weight of the crop decreases.

farmers reported earning a median of 8,000,000 Ariary in revenue in the last 12 months, equivalent to PPP-adjusted USD 7,130, which translates to USD 178 PPP per kilogram.[23]

2 Data

Our study makes use of several datasets collected both before and after the price increase. These datasets include a long-term panel study with information on household-level vanilla production, several nationally representative household surveys, and a census of communes containing information on crop production at the community level.[24]

2.1 Individual-level cohort panel

To analyze the impact of the vanilla price increase on vanilla producers, we use a dataset which follows a cohort of young adults who were surveyed in 2003-04 when they were young teens, then again in 2011-12 when they were around 20 years of age, and finally in 2019-20 when most were in their late twenties. We refer to this as the DEMTREND dataset.[25] The balanced panel includes extensive information on 1,346 cohort members with information on a range of life course transition outcomes, labor and time use, as well as tests of cognitive skills and non-cognitive personality traits. The surveys also include

[23]Without PPP adjustment this is 2,160 USD, which translates to 54 USD per kilogram produced using Google exchange rate of 1 USD = 0.00027 Ariary for October 1st 2019. The PPP-adjusted GDP per capita was USD 1,652 in 2019 (World Bank, 2023a).

[24]The datasets employed and their timing relative to the vanilla price surge are presented in Appendix Figure A1.

[25]The individual survey waves are referred to as the Madagascar Life Course Transition of Young Adults Survey (for the 2011/12 and 2019/20 waves) and the Progression through School and Academic Performance in Madagascar Survey (EPSPAM 2004).

extensive information on the household, such as details on asset wealth and agricultural production.

2.2 Repeated cross-sectional surveys

We combine data from several other household surveys to analyze the effects of the vanilla price shock in the communities producing vanilla. The first pooled cross-sectional dataset we construct combines four nationally representative household surveys: the UNICEF Multi Indicator Cluster Survey (MICS) collected in 2018, which contains extensive information on child well-being, is combined with three Malaria Indicator Surveys (MIS) collected in 2016, 2013, and 2011, which are collected within the Demographic and Health Surveys (DHS) project. These MIS surveys contain information on the demographic characteristics of the household, as well as a range of data on household living standards and information on cluster GPS coordinates.[26] For our analysis we exploit information on asset ownership, educational attainment of female household members, and information on the use of antenatal care services. The same information is available in the MICS, and by combining these data sets we can observe how these outcomes change over time. Since the MICS is wider in scope, we also utilize information collected by the MICS 2018 on child malnutrition, birth weight, and skills, as well as various indicators of parental investment in children's human capital to investigate cross-sectional differences in these outcomes between vanilla regions and the rest of the country.

In addition to the MIS-MICS dataset, we analyze a separate dataset containing multiple waves of the Afrobarometer surveys conducted in Madagascar for the years 2008, 2013, 2015, and 2018. These data are part of a pan-African

[26] The MIS surveys are more limited in terms of the range of questions relative to the full DHS survey.

series of national public attitude surveys on democracy, governance, and society. They also contain information on household economic outcomes, asset ownership, and expectations about the economic situation.

2.3 Commune-level data

To identify the vanilla-producing communities, we use geocoded information from the Commune Census conducted by the National Center for Applied Research for Rural Development (FOFIFA) and the National Statistical Institute (INSTAT) in 2007. Communes are the smallest identifiable geographical locality in the country.[27] From the Commune Census we classify a commune as vanilla-producing if vanilla is listed as one of the top 5 crops cultivated in the community, in terms of either value or land area cultivated. We use the GPS coordinates from our household survey datasets (DEMTREND, MIS-MICS, and Afrobarometer) to identify which clusters in these datasets are located in the vanilla-producing communes by matching Commune Census data to commune-level shapefiles.

2.4 Summary Statistics

The DEMTREND data indicate that, compared to other households, vanilla-farming households became wealthier over time: initially they have a lower average value for the asset index in 2003 and 2012, while in 2019 it is substantially higher than for non-producers.[28] There is a substantial increase in

[27]All communes in the country were included, and focus group interviews were the basis for designing the survey instrument, which collected information on the level of socioeconomic development, including public services, physical and social infrastructure, production and insecurity risk, agricultural production and livestock, transport, and social capital and welfare.

[28]Summary statistics for the DEMTREND panel data, which includes information on vanilla producing households are presented in Appendix Tables A1 and A2. Table A1

informal savings among the vanilla-producing households, from 7.9 per cent in 2003 to 70 per cent in 2019, but no similar increase in formal savings.[29]

Nearly all the cohort members in vanilla-producing households report agriculture as an occupation. While the cohort members in vanilla-producing households are more engaged in agricultural labor in 2012, the gap with non-producers widens in 2019. Producers are also less likely to engage in unpaid household work. While vanilla-farming cohort members have consistently lower test scores than non-producers, a finding in line with their lower grade completion, the gap narrows in both math and French test scores between 2012 and 2019. Similarly the gap in indicators of emotional stability, which is higher for non-producers, disappears over time.

We compare vanilla-producing communities to the rest of the country using the MIS-MICS and Afrobarometer pooled cross-sections.[30] Data from before and after the vanilla price increase show a relative increase in the average asset index of households in vanilla communities compared to households in other regions. There has been an overall increase in ownership of consumer durable goods in particular: for example, while motorcycle ownership has stayed fairly constant in non-vanilla-producing communities, in vanilla communities the ownership rates increased from 5.2 per cent to 12 per cent between 2016 and

displays data for the full sample, such that the first column shows summary statistics on the pooled data (2003, 2012, and 2019), and subsequent columns display the means by year across vanilla-producers and non-producers.

[29] We also compare the pooled means across the years between vanilla farmers and all other households, and also across two comparison groups relevant for our analysis: non-vanilla-producing households living in communities where vanilla is produced; and non-vanilla-producing agricultural households, defined as households that held land or had agricultural production anywhere in the country (Appendix Table A2). While vanilla farmers are slightly wealthier than other agricultural households on average over time, they have lower asset ownership relative to other households in the full sample, and also relative to all other household in the vanilla communities.

[30] See Appendix Tables A3 and A4 for statistics from the MIS-MICS data and Appendix Table A5 for statistics from the Afrobarometer data.

2018 (Appendix Table A3). Mobile phone ownership increased from 32 per cent to 58 per cent during that same period in the MIS-MICS data, with similar increases observed in the Afrobarometer data.

Finally, respondents in vanilla communities were initially just as satisfied with their economic conditions as respondents elsewhere in the country before the price shock, but much more satisfied in 2018. This pattern also applies to their assessments of the country's present economic conditions and improvements in the country's economic conditions over the previous 12 months (Appendix Table A5).

3 Model

We use several empirical models in our analysis. First, we investigate the impact of the vanilla price shock on a range of outcomes for vanilla farmers using our DEMTREND panel data, where the comparison group is members of non-vanilla-producing households. Second, we examine the impact of the price shock on people living in vanilla-producing communities, where the comparison group consists of people living in areas without vanilla production.

3.1 The effects of the price increase on vanilla farmers

For the analysis using the DEMTREND panel data that includes information on household-level vanilla production, we estimate a model that takes the form

$$Y_{iwz} = \alpha_i + \beta_1 Producer_i \times Post_w + \chi_z + \omega_w + \varepsilon_{iwz} \quad (1)$$

where the variable Y_{iwz} denotes outcome of individual (or household) i in wave w and enumeration area, or zone, z.[31] The variable $Producer_i$ takes a value of 1 if the household produces vanilla. The variable $Post_w$ takes a value of 1 for the 2019 survey wave—the only wave after the price increase—and 0 for the previous two waves (2003 and 2012). Individual fixed effects capture time-invariant characteristics of the person (or household), denoted by α_i; χ_z are fixed effects for the person's survey cluster (in the first wave); and ω_w are dummies for the 3 waves of the panel. Standard errors are clustered at the zone level.

The identifying assumption in these analyses is that non-producers provide a good control group for characterizing how outcomes for vanilla producers would evolve in the absence of the price shock. While we cannot directly test this assumption, we can examine how our estimates change when we use different controls groups. We run the analysis using three different comparison groups. First, we use the full sample, comparing vanilla producers to all other individuals in the survey. Second, we restrict our analysis to only those individuals living in vanilla-producing communities, comparing vanilla producers to nearby non-producing households. This comparison helps to address the concern that other region-specific shocks could be influencing our results, especially given the geographic pattern of vanilla production, which is largely concentrated in the northeastern part of the country. However, one limitation of this approach is that the presence of local spillovers to non-vanilla producers might lead us to underestimate the true effect. Third, we restrict our sample to agricultural households. The purpose of this sample restriction is to obtain a comparison group that is most similar to vanilla producers, in terms of capturing cohort members who may have had similar opportunities in life, but

[31] The enumeration areas from which the sample in 2003 were selected were school zones.

who do not all live in vanilla-producing communities.[32]

In addition to the above specification, we implement another empirical strategy that exploits an alternate source of identifying variation. Instead of simply comparing vanilla households to non-vanilla households, we exploit spatial variation in vanilla production to compare people living in vanilla-growing regions to people living elsewhere. This is the same identifying variation that we use when analyzing the repeated cross-sections of nationally representative surveys, discussed further in the following section. However, when using the DEMTREND panel data, we are able to combine the spatial variation with specific information on household-level vanilla production using an instrumental variables (IV) approach. We estimate the same specification displayed in Equation (1), except that we instrument individual-level vanilla production using an indicator for whether the person resides in a vanilla-producing commune.[33] For this specification, we use the sample containing all agricultural households.

3.2 The regional effects of the vanilla price increase

For the analysis using the repeated cross-sections (the pooled MIS-MICS dataset and the pooled Afrobarometer dataset), our model takes the form

$$Y_{iwcd} = \beta_1 Vanilla_c + Post_w + \beta_2 Vanilla_c \times post_w + \delta_d \times \gamma_c + \alpha X_{it} + \varepsilon_{iwcd} \quad (2)$$

[32]We define agricultural households as those that report any land under cultivation or any crop production.

[33]Specifically, we instrument the $Producer_i \times Post_w$ term with the interaction $Vanilla_c \times Post_w$, where $Vanilla_c$ is a commune-level indicator for whether vanilla is reported as one of the top 5 crops in the 2007 commune census.

where the variable Y_{iwcd} denotes the outcome of household or respondent i during wave w in commune c and district d. The variable $Vanilla_c$ takes a value of one if the household resides in a vanilla-producing commune and thus captures the spatial variation of vanilla production. $Post_w$ takes the value one for year 2018 and zero for 2011, 2013 and 2016 in the MIS-MICS analysis, and for the Afrobarometer analysis, $Post_w$ takes the value one for year 2018 and zero for years 2008, 2013 and 2015.

Additionally, we include district-by-vanilla-commune fixed effects, denoted by $\delta_d \times \gamma_c$; these fixed effects capture time-invariant spatial characteristics at the district level, while also accounting for the fact that some districts contain both vanilla-producing and non-vanilla-producing communes.[34] Finally, we also include controls for demographic characteristics of the household denoted by X_{it}. We report regression results using population weights and cluster standard errors at the district level. Since the bulk of vanilla cultivation takes place in rural areas, we focus our analyses on rural households.

We also run an alternative specification where we interact wave dummies with the vanilla community variable $Vanilla_c \times wave_w$ instead of the above specification with $Vanilla_c \times post_w$. In these specifications we compare the coefficient estimates on the interaction term for the wave after the price increase to the estimates corresponding to earlier waves in order to capture the effect of the vanilla price shock on the outcomes of interest. Given that the price hike started at around 2015, for the analysis using the MIS-MICS dataset, we use the 2016 wave as the reference period and consider that the interaction term

[34] As the MIS and the MICS datasets are repeated cross-sections using different communities, we do not necessarily have information on the same community over time. The community in this case refers to the sample cluster, that is, a village. In order to control for time-invariant characteristics for a geographical region, a district is the smallest common geographical unit that reliably contains information from each of the four repeated cross-sectional datasets.

for vanilla commune with the dummy for the fourth wave captures the effect of the price increase within the vanilla-producing communes. For the Afrobarometer dataset, we use the 2015 wave as the reference period. The interaction terms with the pre-shock waves (2011 and 2013 in MIS-MICS and 2008 and 2013 in Afrobarometer), on the other hand, allow us to test for differences in pre-trends across vanilla and non-vanilla communes.

4 Results

4.1 Wealth

We begin by examining the effects of the price shock on household wealth, both for vanilla farmers as well as for the population living in vanilla-producing communities. We find that higher prices led to substantial increases in asset holdings for both groups.

Table 1 presents the difference-in-differences results from the cohort panel dataset showing the impact of the price increase on the wealth of vanilla farmers using a household-level asset index. We estimate the effect relative to three comparison groups: all other cohort members in the full national sample (Panel A); only those cohort members residing in communes where vanilla is produced (Panel B); and only those cohort members (from any region) living in households engaged in agriculture for their livelihoods (Panel C). In a fourth specification we continue to restrict the sample to agricultural households (as in Panel C) and use the commune-level indicator of vanilla production as an instrument for household vanilla production (Panel D).

Across all specifications, we see a large and statistically significant increase in household wealth. The asset index is normalized such that the distribution of the control group of non-producers in the full sample has mean 0 and standard deviation of 1. The coefficient estimates in Panel A therefore correspond to a relative increase in the wealth of vanilla farmers of around 0.45 standard deviations from the comparison group mean. We find slightly larger effects in magnitude—corresponding to a relative increase of 0.54 standard deviations—when we restrict the analysis to only households residing in vanilla-producing communities (Panel B). The coefficient estimates are similar when comparing only to other agricultural households (Panel C), a group that is likely to be most similar to vanilla-producing households.[35] In Panel D, the coefficient estimates using the IV estimator are substantially larger than the previous estimates.[36] Across specifications, the estimates are stable when we add controls (column 2) and when moving to a household fixed effects specification (column 3).[37]

Table 2 displays results comparing households living in vanilla regions to those in other areas of the country using the MIS-MICS pooled cross-sections.[38] The variable "post" is an indicator for the fourth survey round (2018). Vanilla

[35]Relative to the wealth distribution of this comparison group of agricultural households, the fixed effects estimate in Panel C corresponds to an effect of around 0.54 standard deviations. The standard deviation of the asset index for the three comparison groups is 1, 0.97, and 0.82, respectively.

[36]Part of the explanation for this difference is likely due to the fact that some of the households in our sample that report producing vanilla live outside of those communes that are classified as vanilla-producing according to the commune census. The low prevalence of vanilla production in these areas may reflect the poor agroecological suitability for vanilla, such that the vanilla producers that we observe in these areas are less likely to benefit from the price increase. The local average treatment effect (LATE) that we estimate in panel D is identified off of those vanilla producers living in communes where vanilla was one of the top 5 crops in 2007.

[37]Controls include both time varying and time-invariant variables, namely household size, whether the household is new, female household head (in 2012), highest grade attained by the cohort member in 2012, and the cohort members height (in cm in 2012).

[38]Recall that these surveys lack information on vanilla production at the household level. Instead, these estimates exploit the geographic variation in the location of vanilla production shown in Figure 1, and thus represent an average or "intent-to-treat" (ITT) effect across all vanilla-producing and non-vanilla-producing households.

communes are municipalities that reported growing vanilla in the commune census of 2007. We find that the price increase resulted in an increase of around 0.35 standard deviations in the asset index in vanilla-producing communities relative to non-vanilla-producing communities. Columns 3 and 4 of Table 2 show that these results are driven by households living in rural areas, which likely reflects the fact that vanilla farmers reside primarily in rural areas. If we normalize the rural and urban coefficients by the sample-specific distributions, these estimates correspond to a relative increase of about 0.43 standard deviations in rural areas and 0.31-0.37 in urban areas.[39] Within the vanilla-producing regions, a quarter of the survey clusters are defined as urban in the MIS-MICS datasets; in these areas, there is no statistically significant wealth increase as vanilla prices increase as compared to other urban areas of the country (columns 5 and 6 of Table 2). For our subsequent analyses, we restrict the sample to households residing in rural areas only.

Figure 3 displays results using the same pooled MIS-MICS dataset, but instead of using the "post" variable, here the survey wave indicators are interacted with the vanilla commune indicator. Compared to the base year of 2016, we find a similarly large and statistically significant increase in wealth. The figure also allows us to look for evidence of differential trends in the pre-treatment period; we see that, if anything, the trends were in the direction of greater wealth for the non-vanilla regions.[40,41]

[39]The standard deviation of the wealth index is 0.96 in the full sample, 0.64 in the rural sample, and 1.24 in the urban sample.

[40]Appendix Figure A3 replicates this analysis separately for rural and urban areas, showing that while there seems to be some indication of a wealth increase in the urban areas, it is more imprecisely measured than the substantive increase among the rural clusters.

[41]To compare the findings across datasets, we also estimate a similar specification using the DEMTREND panel. Instead of comparing vanilla and non-vanilla households, we examine the effect of residing in a vanilla-producing commune. These estimates represent the "reduced form" of the IV specification in Table 1 (and are displayed in Appendix Table A6 Panels 1 and 2). In the sample containing agricultural households only, the estimated magni-

We also examine the effects of the price shock on the overall distribution of wealth in rural areas using the MIS-MICS repeated cross-sections. For each household living in a vanilla commune, we determine their corresponding rank in the wealth distribution of households in non-vanilla areas in the same time period. This allows us to display the wealth distribution for vanilla areas *relative to* non-vanilla areas, and then plot this relative distribution separately for the pre- and post-shock periods.[42] Figure 4 shows that the distribution of wealth in vanilla communes shifts substantially to the right after the price shock. We can also compare these two distributions in order to estimate a lower bound on the proportion of households affected by the shock. In order to move from the first distribution to the second, it is necessary to increase the wealth ranking of at least 28 per cent of the sample. This means that at least 28 per cent of households living in vanilla communes experienced a relative increase in wealth after the price shock, though the actual number could be much higher.

A factor contributing to these large benefits at the community-level is the high level of engagement in vanilla production by a large share of the households in the vanilla producing regions. Using the DEMTREND sample, we find that about 38 per cent of households living in the vanilla-producing communes (as determined by the commune census) are producing vanilla in 2019-20, com-

tudes are roughly similar to the coefficient estimates for the rural sample in Table 2: around 0.28 in the MIS-MICS vs. 0.33 in DEMTREND (Panel 1 of Table A6), despite different samples used for analysis. When we relax the sample restriction in the DEMTREND panel to include all households (including those residing in urban areas), the reduced form results are no longer statistically significant (Panel 2 of Table A6). Compared to the ITT estimates from Banerjee et al. (2015), who conducted poverty graduation programs in six countries with large transfer sizes (Romero et al., 2021), our asset index estimates are slightly higher for households in vanilla communities (around 0.34 SD in Panel 1 of Table A6 vs. 0.258 SD in Banerjee et al. 2015), and also the annual vanilla revenue has been higher than the transfer size, USD 7,132 vs. USD 6,475 (PPP).

[42]We aggregate the 3 MIS pre-shock surveys and display one overall distribution for the pre-period.

pared to less than 1 per cent of households living in other communes. We find similar numbers using an alternative source of data: in the 2010 wave of the periodic household survey conducted by the government of Madagascar, 37 per cent of rural households living in the vanilla communes report growing vanilla, compared to less than 1 per cent of households in other areas.[43]

The vanilla shock also translates to sizable changes along important thresholds of the welfare distribution. Given that 80.7 per cent of the Malagasy population lived under the international poverty line in 2012, in Appendix Table A7 we estimate a model where we proxy this threshold in the welfare distribution by studying how the shock changes the probability of being in the bottom 80.7th percentile of the asset distribution.[44] We find a 4.6 percentage point decrease in the probability of falling under this asset poverty threshold after the shock, an 8 per cent reduction from the rural mean. Indeed, this is in line with the share of rural households in the vanilla region being asset poor declining from 97 per cent between 2011-2016, to 93 per cent in 2018. This change at the upper portion of the rural wealth distribution is accompanied by a large shift around the the median. While between 2011-2016 51 per cent of the rural households in the vanilla region were in the top 50th percentile of the rural wealth distribution, in 2018 this share increased to 76 per cent.

We also investigate which specific assets contribute to these increases wealth. In the cohort panel, we find that the ownership of mobile phones, motorcycles and TVs increased substantially among vanilla producers relative to all com-

[43]This survey is known as the Enquête Périodique auprès des Ménages 2010 (EPM 2010). To determine which households lived in vanilla communes, we merged the EPM 2010 with data from our commune census.

[44]This is meaningful as the welfare metric used for the 2.15 USD per day (in 2017 PPP) measured from consumption is strongly correlated with the asset distribution (Sahn and Stifel, 2003), and thus is used as a proxy for welfare in the absence of such consumption data (Brown et al., 2019).

parison groups.[45] We find broadly similar results using the MIS-MICS dataset: households living in vanilla-producing communes see a 50 per cent increase in the ownership of mobile phones and a 38 per cent increase in having a finished roof. There is also a nearly three-fold increase in the ownership of motorcycles, from a low mean level of 4.5 per cent. We also see significant increases in ownership of radios and watches, but no significant effect on cars or bicycles.[46]

Next we investigate the impact on other financial outcomes for vanilla producers in the wake of the price increase, and the results are displayed in Table 3. We find a substantial relative increase in the use of informal savings services, but no increase in savings in formal savings institutions or in the prevalence of taking loans. These effects are taking place during a time when formal savings are increasing among the sample, both in vanilla and non-vanilla regions. At the same time informal savings are decreasing, but with a slower pace in vanilla regions (Appendix Table A1). We also find that vanilla farmers are less likely to receive remittances after the price shock, while there is no significant difference in the likelihood of sending remittances. In fact, almost none of the vanilla producing households are receiving or sending remittances in 2019 (Appendix Table A1).

While we cannot exclude the possibility that there are demand constraints for formal savings, the fact that we see no effects on formal savings suggests

[45] These results are reported in Appendix Table A8. In the regressions using the full sample (Panel A), mobile phone ownership increased 33.6 percentage points, corresponding to an 86 per cent increase from the comparison group mean (39 per cent). Similarly, motorcycle ownership increased by 24.6 percentage points—a 4.4-fold increase from the comparison group mean of only 5.5 per cent (Appendix Table A2). The assets for which we observe no relative difference by vanilla production include cars, bicycles, and refrigerators or freezers.

[46] These results are reported in Appendix Table A9, relative to the means reported in Appendix Table A3. Car ownership is rare in rural areas, and many households only have access to their dwellings via small paths rather than roads that can be accessible cars. We also report the results for specific assets in the Afrobarometer survey in Appendix Table A9; the standard errors are much larger, likely due to the smaller sample size, and only one of the four assets shows a statistically significant effect.

that the barriers could be driven by the lack of supply, which is consistent with the paucity of banks in rural areas. The decrease of received remittances could well indicate that there is widespread knowledge within their social network about the wealth increase experienced by vanilla producers.

4.2 Adult psychological outcomes and time use

Next, we examine how the price rise and corresponding improvements in economic well-being relate to the non-monetary well-being and time use of adult vanilla producers.

In Figure 5 and Table 4, we present evidence from the Afrobarometer surveys that indicate that the increases in wealth described in the previous section are accompanied by improvements in people's perceptions of the economy and their own economic well-being. Following the vanilla price increase, respondents living in in vanilla-producing areas are more likely to characterize their own current living conditions in positive terms. The same result holds when people are asked to assess the present economic conditions in the country as well as the changes in the country's economic conditions over the previous 12 months. And these positive assessments also correspond to greater optimism about the country's future economic trajectory: following the price shock, people in vanilla-producing areas are more optimistic in their expectations concerning the country's economic conditions over the next 12 months time.

We then investigate the effects on the psychological well-being of adult vanilla producers and display the results in Table 5. We construct indices of emotional stability using 19 questions from the non-cognitive personality questionnaire administered to the DEMTREND cohort. Respondents were asked to rate their agreement (on a scale of 1 to 5) with questions such as "I am often worried" and "I fear the worst will happen".[47] We construct two indices: in column 1, the dependent variable consists of the average of the cohort member's responses across all 19 questions (on a scale of 1 to 5, and negating the sign on certain questions so that higher values indicating better scores); in column 2, the dependent variable is constructed using factor analysis on the 19 questions following the approach of Sahn and Villa (2016).[48] We interpret these estimates on emotional stability as proxies for the effects on the individual's psychological well-being, relying on previous research that has shown that emotional stability is highly correlated with measures of psychological well-being (DeNeve and Cooper, 1998; Hills and Argyle, 2001; Winzer et al., 2021).

The results in Table 5 indicate that the price shock leads to improvements in the psychological well-being of adult members of vanilla-producing households. When we restrict the sample to agricultural households only (Panel C), the estimates are significantly different from zero and the magnitudes are sizeable: the coefficient in column 1 translates to a relative increase of 0.45 standard deviations, and the coefficient in column 2 translates to a 0.39 standard deviation increase from the comparison group mean. In panel D, the coefficient estimates are again much more sizable, over 1 standard deviation increase from the comparison group mean. When we expand the comparison groups to include non-agricultural households, however, the statistical significance declines: one of the estimates in Panel B is not significantly different from zero, and the other estimates in Panels A and B are only marginally

[47]The full list of 19 questions is displayed in Appendix Table A10.

[48]We use as our dependent variable the individual's score on the Big 5 trait known as "neuroticism" or "emotional instability", but we negate the sign so that higher values correspond to lower levels of neuroticism and therefore higher levels of emotional *stability*. The DEMTREND module on non-cognitive traits contained a series of questions designed to measure the "Big 5" personality traits, including the 19 questions related to emotional stability.

significant (at the 10 per cent level), though similar in magnitude to those in Panel C. These magnitudes are large relative to the estimates reported in the literature on economic transfers to households (Romero et al., 2021), where the average effect in low-and middle-income countries 0.115 SD, albeit with much lower transfer sizes on average.

We also look at whether the price increase confers any impact on the cognition of producers. There are several channels through which the price shock could affect cognitive performance. Poverty can impede cognitive performance (Mani et al., 2013), thus given the large income shock we might expect a positive effect due to reduced cognitive load. Additionally, if higher prices lead to increases in work, this could also have a positive effect on cognitive skills (Jedwab et al., forthcoming). Finally, another mediating factor could be the change in stress levels as a result of the shock. Stress levels can contribute to changes in cognitive function (McEwen and Sapolsky, 1995; Comijs et al., 2011; Marina et al., 2011; Shields et al., 2017; McManus et al., 2022), although signing the impact of the price shock is difficult: it could potentially lead to increases in stress due to increases in work or the need to protect crops against theft; or a decline in stress as households members feel more financially secure.

We find that the shock has improved vanilla farmers' performance in the math test, but not in the French test. The estimated impacts on math scores shown in Table 5 correspond to relative increases of 0.36, 0.24, and 0.30 standard deviations (across Panels A, B, and C, respectively) with around twice the magnitude in Panel D relative to Panel C (consistent with results on other outcome variables). Indeed, French skills have improved across the entire cohort between 2012 and 2019, but math skills have improved only among the vanilla farmers, while they have stayed roughly at the same level for others (Appendix Table A1). The increase in math skills among vanilla farmers may be indicative of an increased interest and experience in agricultural sales and marketing to maximize vanilla revenue and overall reducations in stress. The lack of change in French skills may be due to the fact that local languages dominate in vanilla growing regions.[49]

We also examine whether the increase in wealth is accompanied by a change in labor supply among vanilla producing households, both the hours of work supplied, as well as the labor allocation between agricultural and non-agricultural sectors. Overall, labor supply is increasing among the entire cohort between 2012 and 2019, but cohort members in vanilla-producing households are no more likely to be employed than those in non-producer households (Appendix Table A11). We do, however, observe a relative difference in terms of the type of work activity. After the shock, vanilla farmers spend relatively more time working in agriculture than in other paid activities. Non-vanilla producers are supplying relatively more labor in the non-agricultural sectors and less often report having an agricultural occupation, while vanilla farmers are increasing their labor supply in agriculture and more often report having an agricultural occupation.[50]

We also observe a significant impact on time spent in unpaid activities. The price shock reduces time spent in unpaid activities by around 55 minutes per day, namely in household chores and caretaking responsibilities.[51] In 2019, the

[49]Furthermore, the finding is in line with (Aubery and Sahn, 2021) who find that unusually good harvests had a positive impact on math scores. Furthermore, language skills in adulthood are more strongly associated with the home environment in childhood than math skills are, indicating that math skills may be more malleable in adulthood (Kaila et al., 2023).

[50]Ninety-seven per cent of cohort members in vanilla-producing households had an agricultural main occupation in 2019, and they spent 91 per cent of their working hours in agriculture during the previous 12 months, relative to other cohort members who spent just 34 per cent of their time in agriculture (Appendix Table A1).

[51]These results are displayed in column 7 of in Appendix Table A11. The results using the IV strategy (in Panel D) show a larger reduction of 2.5 hours. Note that when using

average cohort member in a vanilla-producing household spent just 93 minutes in household unpaid activities, while cohort members in non-vanilla households spent over 2 and a half hours in these tasks a day (Appendix Table A1).[52]

4.3 Children's human capital

We also investigate whether the shock resulted in changes in investments in children, and children's human capital outcomes in vanilla-producing communities. In contrast to our results above for adults, we generally find no significant effects on child-related outcomes.

4.3.1 Education

We first examine the effects on child education. The vanilla shock may have altered the opportunity cost of schooling, although the sign of the effect is not clear a priori. On the one hand, increased incomes may lead to households having more resources to educate their children. On the other hand, the opportunity cost of schooling may be high if the alternative is supplying labor on farm.

Information on individual education in the three MIS waves is available only for women ages 15 and older. We restrict our analysis to women aged 15-19 and examine the effect on years of education.[53] We estimate a specification

the IV specification we also see some evidence of an increase in hours worked in the main activity. Overall, the results may indicate that compared to agricultural households, the vanilla producers have shifted some of their unpaid labor into their main agricultural activity, while compared to other comparison groups, there has not been a change in labor supply.

[52]These tasks include work inside the house such as housekeeping, repairs, laundry, grocery shopping and other household purchases, and preparing meals; fetching water; fetching firewood; taking care of children; taking care of the elderly; and, taking care of the sick.

[53]We limit our analysis to women 15-19 years of age in order to isolate women in the final wave who could most plausibly have their educational attainment influenced by the recent price shock.

using the four waves of pooled MIS-MICS data for girls' education. The results in column 1 in Table 6 indicate that there is no impact of the vanilla price shock on girls' years of education. (Appendix Figure A4 plots the estimated effect over time, showing that there is also no pre-trend in the outcome of years of education.) The estimate in column 2 shows that there is likewise no significant effect on whether girls in this age group are literate.

4.3.2 Health

In addition to schooling outcomes, we also examine the effects on child health. For this analysis we rely on cross-sectional comparisons using the 2018 MICS data. Height and weight were collected for all children under five years of age at the time of the survey, from which we construct anthropometric variables for height-for-age, height-for-weight, and weight-for-age used to assess nutritional status.[54] We compare outcomes for children based on their date of birth, which provides some degree of variation in their exposure to the price shock. The results in Figure 6 indicate that children under 5 in vanilla regions had equally low health status compared to children in other rural areas of the country, regardless of whether they were born before or after the price shock. Given that height-for-age is a stock variable of health and nutritional inputs since in-utero and over a child's lifetime until the age of five, if the price hike has a positive health effect, we would expect it to be more pronounced among the younger children born after the price increase, than for older children, given that the oldest children in the sample were born (and in-utero) before the price-hike. Weight however can fluctuate faster and thus we would not necessarily expect height-for-weight and weight-for-age to vary considerably

[54]The MIS surveys collected before the shock do not include this information.

by age. However, we observe that the levels of these variables are also the same within vanilla and non-vanilla regions, thus indicating no differences in the health status among children in the two regions. Similarly, we observe no statistically significant differences in the rates of malnutrition among children in vanilla and non-vanilla regions (Appendix Figure A5).[55]

The MICS 2018 also includes birthweight data for the most recent birth of a woman from the two years preceding the survey. Our results indicate that there is no trend in birthweights (Appendix Figure A6). While in the absence of pre-shock data we cannot rule out that the price hike may have improved birth outcomes, we do not find any indications that after the shock, children in vanilla regions are any healthier than rural children elsewhere.

4.3.3 Inputs on children's human capital

In order to gain further insight into the absence of increased use of health services and improvements in young children's human capital outcomes, we next examine health inputs in the form of antenatal service use and antimalarial drugs taken during pregnancy (Table 6) using the MIS-MICS 4-wave repeated cross-section. We find no effects on antenatal care, and the mother having received any intermittent preventive treatment of malaria (IPTp) drugs as a antimalarial recommended during pregnancy, although we do find a decrease in the IPTp at the margin of 2 or more doses. Furthermore, using the 4-wave repeated cross-section, we find no increases in caring for a child with fever, and if anything, we find a decrease in the prevalence of sleeping under a bednet and bednet ownership in the household, although no associated increase

[55]The malnutrition indicators are stunting, wasting, and underweight, which indicate if a child is below 2 standard deviations from the WHO reference median of in their height-for-age, weight-for-height, and weight-for-age, respectively.

in the prevalence of fever among children (Appendix Table A12).[56] Furthermore, in line with the findings on antenatal care, we find no increase in birth certification for children born before the start of the vanilla price shock and after (Appendix Figure A7) using birth history information from MICS 2018. These findings in terms of health inputs are thus consistent with the lack of improvement in health outcomes.

In order to better understand the failure to observe significant health effects, we perform two sets of additional analyses using the detailed cross-sectional information available in the 2018 MICS. We first consider whether there is evidence for an opportunity cost effect, whereby parents reduce the time spent in child-related care or activities. We may expect this to be the case based on evidence from Brazil (Charris et al., 2024), although given no increase in the overall labor supply of vanilla farmers as discussed above (Appendix Table A11), we may also expect this not to hold in our case. We examine the effects on a broad range of measures of parental involvement with their children. The results are summarized in Appendix Table A13. Across most measures we see no significant difference between people living in vanilla regions and those in other areas. Among those variables that show a significant difference, most of the estimates are positive, indicating that if anything parents in vanilla-growing regions spend more time taking care of their children. While it is difficult to draw strong conclusions from these cross-sectional patterns, the pattern is not what we would expect to see if parents in vanilla areas were substantially altering their time spent with children.

[56] Malaria being seasonal, measures taken to prevent malaria may vary by month. The result in the decrease of preventative measures may be explained by the variation in survey months across the different waves of the MIS-MICS waves and the MICS.

4.3.4 Skills

We next perform a second set of cross-sectional analyses where we analyze multiple human capital outcomes for both adults and children in order to compare the effects across these groups. The purpose of this analysis is to better understand whether the differences in results for adults relative to children can be explained by differences in the data sets and empirical strategies used. More specifically, first we show the cross-sectional comparisons of children's skills acquired in school, namely math and reading skills that were tested as part of the MICS 2018 survey among children between 7-14 years of age (Appendix Table A15). We find that, on average, children in vanilla communities do not have any higher skills than elsewhere in the country (when controlling for individual and household characteristics). When we examine heterogeneous effects by age, however, we see that that older children in vanilla-growing areas are likely to perform better in both math (Appendix Figure A8) and reading skills (Appendix Figure A9), while younger children are likely to perform worse. The results for older children and adults are thus similar in that there is an improvement in math and language skills, even in the absence of changes in educational attainment.

4.3.5 Mental health

We also investigate mental health outcomes of children 5-17 years of age and find no statistically significant cross-sectional differences between children residing in vanilla regions and those living elsewhere (Appendix Table A15). These findings contrast with our earlier difference-in-differences results for adults, which showed improvements in emotional stability and perceptions of economic well-being. For comparison with the cross-sectional analysis for children, we also examine whether our measure of economic "optimism" for adults is higher in the post-shock Afrobarometer wave in the vanilla region. We find that the coefficient estimate for vanilla commune is positive, showing that adults living in the vanilla region are more likely to report positive expectations regarding future economic conditions (final row of Table A15). We obtain similar results from cross-sectional analyses of the other Afrobarometer outcomes; these results are shown in Appendix Table A16.

4.3.6 Functional difficulties

Finally, we also examine cross-sectional differences in the prevalence of functional difficulties. This variable has the advantage that information is available within the same data set for both children and adults. We find similar heterogeneities by age as with reading and math skills, such that we do not find any changes in functional difficulties for children below 13 years of age, but there is a decline in functional difficulties for some age groups among teenagers (14-15 and 18-20 year-olds), as well as for some age groups among adult household members (Appendix Figure A10).

In summary, the results from these cross-sectional analyses continue to display a similar age pattern as before: we generally find significant and positive effects for adults, but insignificant effects for children. In addition, for several outcomes, we observe a similar age gradient within the sample of children, in that the effects are larger for older children than for younger children. This suggests that the lack of significant effects for children is not necessarily fully explained by differences in the outcomes that we are able to observe. Instead, it may be the case that the extent to which individuals are affected by this sort of shock is partly of a function of age, with older children and adults more likely to be affected, and younger children less so.

4.3.7 Environmental factors

Child health status is affected by many factors from nutrient intake to health care. Additionally, the quality of water and sanitation can also affect children's health through bacterial contamination. In line with the null results on children's health outcomes, we find no improvement in terms of households having better access to any kind of protected water source, or to a piped water source (Appendix Table A17). In terms of sanitation, there is also no increase in the probability of having a toilet facility, nor is there an increase in sewage hookups in the vanilla enumeration areas (Appendix Table A17). As with the issues regarding access to health care, all these environmental indicators show no improvement in the short-term after the price shock, consistent with the no change observed in the health outcomes of children under 5 years of age in the vanilla regions.

4.4 Effects on non-producers

In Table 7 we investigate whether there were positive spillovers to non-producers in vanilla communities as a result of higher vanilla prices using the DEMTREND data. We investigate this by interacting the vanilla commune variable with "producer X post", as well as with "non-producer X post", a group that includes everyone in those communities except the vanilla farmers. The omitted category is everyone living in communes with no vanilla production at all.[57]

The results indicate that the increases in wealth in vanilla communes are driven almost entirely by the vanilla producers living in these areas. Using

[57]For this analysis, we exclude the subset of vanilla producers residing outside of vanilla communes.

all households in the full sample, we find no statistically significant effect on wealth for non-producers living in vanilla communes. When we restrict the analysis to agricultural households, we do see some evidence of a positive effect for non-producers, but the result is only marginally significant (at the 10 per cent level), and the magnitude is a quarter the size of the impact on producers. While there is no strong evidence for large positive wealth spillovers on non-producers, the estimates in panel C do allow us to rule out substantial *negative* spillovers: the lower bound on the 95 per cent confidence interval represents only a small decline of about 0.02 standard deviations. Taken together with the findings from Table 2 and Figure 4 that point to large increases in overall wealth of these communities, our evidence suggests that while benefits are widespread and sizable, they are strongly concentrated on vanilla producers with no conclusive evidence in support of positive spillover effects on non-producers.

5 Robustness checks

5.1 Accounting for cyclone exposure

Vanilla farmers face uncertainties because of environmental and climatic factors that can adversely affect the vanilla harvest. On March 7, 2017, the Enawo cyclone hit the Northern coast of Madagascar with maximum sustained winds at 205 km/h (125 mph). Enawo made landfall over the vanilla-producing Sava region (between Antalaha and Sambava), representing the strongest cyclone to hit the country since 2004. The cyclone started to rapidly weaken as it moved inland, but caused major damage to infrastructure along the coast.

Given the expectation that exposure to the cyclone may have altered household financial decisions and choices regarding human capital investments, we run alternative specifications accounting for being exposed to Enawo. This is defined by residing in a location exposed to tropical cyclone force winds. The data for the cyclone track was obtained from the IBTrACS project.[58] Exposure was then modeled using the parametric wind speed model by Willoughby et al. (2006).[59] The optimal information for assessing the severity of the cyclone is the precise geolocation of the track of the cyclone with the highest wind speed.

We model the maximum sustained wind speed at each of the cluster GPS-coordinates of our various household surveys to create a cyclone exposure variable, which is defined as experiencing winds that exceed the threshold of category one cyclone with sustained winds at >33 m/s (74 mph). We find that 21 per cent of households in the vanilla growing regions in the MICS 2018 were exposed to the cyclone, while none of the vanilla farmers in the DEMTREND panel were exposed to the cyclone.[60]

Our expectation is that the exposure to a cyclone negatively impacts durable asset ownership such that our wealth and household infrastructure and durable asset ownership results may be downward biased. We run an alternative specification where we exclude households in clusters that were exposed to tropical cyclone winds (that is, we exclude the households in MICS

[58] The IBTrACS Project, developed by the National Oceanic and Atmospheric Administration (NOAA) National Climate Data Center (NCDC), compiles best track data from forecast centers around the world to create a global dataset of 97 tropical cyclone locations and intensities (Knapp et al., 2010).

[59] The Willoughby et al. (2006) model is implemented using an adaptation of the software *stormwindmodel* in R following Tennant and Gilmore (2020). The model allows us to translate the storm tracks into estimates of maximum sustained wind speed in a 6-hour interval.

[60] There were 21 non-vanilla farmer households in DEMTREND panel exposed to the cyclone. We have run our key results omitting these households, and the results are robust to this specification.

2018 who were exposed to Enawo in 2017, as well as households that were in these locations in previous rounds). The results are reported in Appendix Table A19, and the estimates are very similar to our earlier results in Table 2 and Appendix Table A9.

5.2 Alternative specifications

In addition to the cyclone exposure, we run several other robustness checks for our main wealth results.

Our panel consists of cohort members who were living in the households of their childhood when first interviewed as teenagers in 2003. The majority of them have formed their own households either before 2012 or before 2019. We run a series of checks to determine whether our household wealth results are affected by changes in household status. (These results are displayed in Appendix Table A20.) We find that controlling for changing household status has almost no effect on our estimates. We also examine the impacts separately for people who change households and people who do not; this can shed light on whether the wealth effects are driven by people moving into vanilla households between wave 2 (2012) and wave 3 (2019). If anything, we find that the estimates are larger for people who do not move between these waves. Vanilla producers who have already formed new households by 2012 (and are thus less likely to move again in response to the shock) see somewhat larger increases in wealth that people who remain in their original households, though the differences are not statistically significant (column 4 of Table A20). Likewise, vanilla producers who do not change households between waves 2 and 3 experience greater increases in household wealth relative to people moving into households that subsequently report vanilla production (column 5 of Table A20). Taken together these findings indicate that selection arising from changes in household formation is unlikely to be driving our household-level results.

Second, we estimate alternative specifications for the MIS-MICS dataset to account for the timing of the 2016 MIS, which was carried out during the initial stages of the price increase. In the difference-in-differences specification in Table 2, we included the 2016 wave as part of the pre-treatment period, under the assumption that some time lag is expected before producers would be fully affected by the price change. Here we discuss the results of several alternative specifications. First, in place of the "post" indicator, we instead interact our indicator for vanilla communes with the global vanilla price during the time of each survey.[61] This specification is meant to account for the fact that prices had already begun to rise in 2016, but would continue to rise even further by 2018. The results are presented in Appendix Table A21, and are generally consistent with the results from our main specification.

Next, we investigate a model where instead of creating a "post" indicator that is equal to one for the 2018 wave, we interact each wave indicator with the vanilla variable keeping the 2013 wave as the reference wave to understand whether the price increase affected producers already in 2016, or later in 2018, to justify the choice of our "post" indicator in our main specification using this dataset. These results are presented in Appendix Table A22. We can see that indeed the wealth increase is not statistically significant in 2016 (relative to the new base year of 2013), while it is in 2018. Finally, we estimate a specification where we simply exclude data from 2016; these results are shown in Appendix Table A23. We find that the results remain robust to excluding this period at the start of the price increase.

[61]The data used is displayed in Figure 2 using data from the COMTRADE database.

5.3 Attrition

Finally, we check whether attrition in the DEMTREND panel is affecting our results. The annual attrition in the panel is 2.1 per cent between 2003 and 2019, and 3.7 per cent during the two waves during which the cohort members were adults (2012 and 2019).[62]

To investigate whether our results are driven by selection into the sample in the follow-up waves, we rerun our main results in Tables 1, 3, and 5 with inverse probability weights adjusting for baseline characteristics in 2003. We adjust for the sex and age of the cohort member, household size, whether the household had electricity and a toilet, and the education level of the mother and father. The results for the full sample are presented in Appendix Table A24. We find that our results remain robust to the attrition adjustment.

6 Concluding remarks

Export crops can provide households with a high-value income-generating opportunity that is less dependent on local demand. For countries with high levels of poverty and large portions of the population engaged in agricultural production, efforts to promote the production of export crops offer a potentially attractive strategy for economic development. The findings in this paper contribute to the long-standing debate on the extent to which export crop production can lead to improvements in living standards and well-being for the rural poor. We show that cash crop production in a time of high prices can lead

[62] In 2003, 2011 cohort members were interviewed, and in 2012, 1,735 of them were tracked. In the data collection that started in October 2019 we were able to find 1,341 cohort members from the 2003 cohort (of which 1,226 were interviewed in 2012, and the remaining 115 only in 2003) before the COVID-19 lockdown in March 2020. By then, all enumeration areas had been visited, but the data collection was still ongoing in localities where the re-interview rates were lowest.

to large and widespread benefits within the producing communities. Despite the remote setting, high levels of poverty, and multiple levels of intermediaries in the value chain, we find large increases in average wealth among rural households in vanilla-growing regions and among vanilla farmers in particular.

We also show how this income shock affects individual-level human capital and document important heterogeneity in these effects for people of different ages. We see positive impacts on adults, who experience improvements in psychological well-being and cognitive performance, but we find no significant effects on children's health or schooling. These null effects for child outcomes are consistent with our other findings regarding inputs into the health and human capital of children. Specifically, there is no increase in the time that adults spend working and no reduction in their time spent caring for children. Overall, the opportunity cost of investing in children's human capital appears to be relatively unaffected by the price shock, which would explain the lack of any negative impacts on children in our setting. The lack of any *positive* effects on children's human capital, on the other hand, could be explained in part by our finding that there is no increase in the use of health care services or in access to clean water or improved sanitation.

Overall, our findings are in line with existing evidence on unconditional cash transfers. There is robust evidence that unconditional cash transfers lead to significant improvements in economic circumstances and positive effects on psychological well-being for adults (Romero et al., 2021). But the evidence related to schooling and child health outcomes is more mixed, with many studies finding effects that are small or insignificant (Haushofer and Shapiro, 2016; Zimmerman et al., 2021). It is worth noting that these studies, like ours, tend to focus on evaluating relatively short-term effects. This raises the possibility that the heterogeneous effects we observe could be related to the time frame of our analysis.[63]

A comparison between our findings and those of Adhvaryu et al. (2019a) provides support for this conjecture. In one of the few other studies to analyze the impacts of crop price shocks on psychological well-being, they show that cocoa price fluctuations faced early in life by children in Ghana are positively related to their psychological well-being *later in adulthood*. Their study of the long-term effects of childhood shocks is in contrast to our setting, where we find sizable contemporaneous impacts on adults but little evidence of short-term effects on any outcomes for children.[64] The contrasting results between our papers could indicate that the dynamic effects of household income on individual human capital differ between adults and children, with positive effects for children taking more time to appear.[65]

An important limitation of this paper is that we lack information about longer-run effects, which means that we are not able to directly test this conjecture. Nonetheless, several of our findings raise the possibility of dynamic impacts over time. Increases in savings and asset accumulation could contribute

[63]For example, despite finding large effects of unconditional cash transfers on household consumption and adult psychological well-being, Haushofer and Shapiro (2016) find no effects on child health or education. They explicitly note that this could be attributable to the short-term nature of their evaluation (nine months after treatment).

[64]For children's psychological well-being specifically, we are only able to examine cross-sectional differences after the price shock, but it is notable that we find no significant differences in reported anxiety or depression.

[65]Indeed, Andersen et al. (2022) and Agness and Getahun (2024) have provided direct evidence for these dynamic effects in their respective analyses of an Ethiopian housing lottery that led to substantial increases in wealth and disposable income. Andersen et al. (2022) find increases in overall life satisfaction for adult lottery winners two years after the lottery. When Agness and Getahun (2024) examine the longer-run effects, they find significant increases in children's human capital outcomes eight years later, but they note that these effects take time to materialize and would thus be missed in short-run evaluations. Additional evidence on the dynamic effects of asset transfers is provided by Banerjee et al. (2021) in their 10-year follow-up analysis of a multifaceted anti-poverty program; they find that the positive health and income effects not only persist over the long-term, but the magnitude of these effects grows over the first seven years following the transfer.

to increased resilience, enabling households to better cope with shocks. The improvements in cognitive skills and emotional stability could lead to increased earnings potential for adults, amplifying the direct income effects. And the improvements in psychological well-being for adults could lead to improvements in the household environment that children grow up in or to better relationships between parents and children.

References

Adhvaryu, Achyuta, James Fenske, and Anant Nyshadham (2019a) "Early Life Circumstance and Adult Mental Health," *Journal of Political Economy*, 127 (4), 1516–1549.

Adhvaryu, Achyuta, Namrata Kala, and Anant Nyshadham (2019b) "Booms, Busts, and Household Enterprise: Evidence from Coffee Farmers in Tanzania," *The World Bank Economic Review*, 35 (3), 586–603.

Agness, Daniel and Tigabu Getahun (2024) "Housing and Human Capital: Condominiums in Ethiopia."

Almond, Douglas and Janet Currie (2011) "Killing Me Softly: The Fetal Origins Hypothesis," *Journal of Economic Perspectives*, 25 (3), 153–72.

Almond, Douglas, Janet Currie, and Valentina Duque (2018) "Childhood Circumstances and Adult Outcomes: Act II," *Journal of Economic Literature*, 56 (4), 1360–1446.

Andersen, Asbjørn G., Andreas Kotsadam, and Vincent Somville (2022) "Material resources and well-being â Evidence from an Ethiopian housing lottery," *Journal of Health Economics*, 83, 102619.

Angrist, Joshua D. and Adriana D. Kugler (2008) "Rural Windfall or a New Resource Curse? Coca, Income, and Civil Conflict in Colombia," *The Review of Economics and Statistics*, 90 (2), 191–215.

Atkin, David (2016) "Endogenous Skill Acquisition and Export Manufacturing in Mexico," *American Economic Review*, 106 (8), 2046–85.

Aubery, Frédéric and David E Sahn (2021) "Cognitive achievement production in Madagascar: a value-added model approach," *Education Economics*, 29 (6), 670–699.

Banerjee, Abhijit, Esther Duflo, Nathanael Goldberg, Dean Karlan, Robert

Osei, William Parienté, Jeremy Shapiro, Bram Thuysbaert, and Christopher Udry (2015) "A multifaceted program causes lasting progress for the very poor: Evidence from six countries," *Science*, 348 (6236), 1260799.

Banerjee, Abhijit, Esther Duflo, and Garima Sharma (2021) "Long-Term Effects of the Targeting the Ultra Poor Program," *American Economic Review: Insights*, 3 (4), 471–86.

Barr, Andrew, Jonathan Eggleston, and Alexander A Smith (2022) "Investing in Infants: the Lasting Effects of Cash Transfers to New Families*," *The Quarterly Journal of Economics*, 137 (4), 2539–2583.

Bastagli, Francesca, Jessica Hagen-Zanker, Luke Harman, Valentina Barca, Georgina Sturge, and Tanja Schmidt (2019) "The impact of cash transfers: a review of the evidence from low-and middle-income countries," *Journal of Social Policy*, 48 (3), 569–594.

BBC (2019) "The children in prison for stealing vanilla," October 1.

Beck, Ulrik, Saurabh Singhal, and Finn Tarp (2018) "Commodity Prices and Intra-Household Labor Allocation," *American Journal of Agricultural Economics*, 101 (2), 436–454.

Beshir, Habtamu Ali and Jean-François Maystadt (forthcoming) "Price Shocks and Human Capital: Timing Matters," *Economic Development and Cultural Change*, 0 (ja), null.

Bossuroy, Thomas, Markus Goldstein, Bassirou Karimou, Dean Karlan, Harounan Kazianga, William Parienté, Patrick Premand, Catherine C Thomas, Christopher Udry, Julia Vaillant et al. (2022) "Tackling psychosocial and capital constraints to alleviate poverty," *Nature*, 605 (7909), 291–297.

Brown, Caitlin, Martin Ravallion, and Dominique van de Walle (2019) "Most of Africa's nutritionally deprived women and children are not found in poor households," *Review of Economics and Statistics*, 101 (4), 631–644.

Cadot, Olivier, Laure Dutoit, and Jaime de Melo (2008) "The Elimination of Madagascar's Vanilla Marketing Board, 10 Years on," *Journal of African Economies*, 18 (3), 388–430.

Carneiro, Pedro, Italo López García, Kjell G. Salvanes, and Emma Tominey (2021) "Intergenerational Mobility and the Timing of Parental Income," *Journal of Political Economy*, 129 (3), 757–788.

Carrillo, Bladimir (2020) "Present Bias and Underinvestment in Education? Long-Run Effects of Childhood Exposure to Booms in Colombia," *Journal of Labor Economics*, 38 (4), 1127–1265.

Cesarini, David, Erik Lindqvist, Robert Östling, and Björn Wallace (2016) "Wealth, Health, and Child Development: Evidence from Administrative Data on Swedish Lottery Players," *The Quarterly Journal of Economics*, 131 (2), 687–738.

Charris, Carlos, Danyelle Branco, and Bladimir Carrillo (2024) "Economic shocks and infant health: Evidence from a trade reform in Brazil," *Journal of Development Economics*, 166, 103193.

Cogneau, Denis and Rémi Jedwab (2012) "Commodity price shocks and child outcomes: The 1990 Cocoa Crisis in Côte d'Ivoire," *Economic Development and Cultural Change*, 60 (3), 507–534.

Comijs, Hannie C, Tessa N van den Kommer, Rebecca WM Minnaar, Brenda WJH Penninx, and Dorly JH Deeg (2011) "Accumulated and differential effects of life events on cognitive decline in older persons: Depending on depression, baseline cognition, or ApoE $\varepsilon 4$ status?" *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 66 (suppl_1), i111–i120.

Cont, Walter and Guido Porto (2014) "Measuring the Impact of a Change in the Price of Cashew Received by Exporters on Farmgate Prices and Poverty in Guinea-Bissau," Policy Research Working Paper 7036.

Cunha, Flavio and James Heckman (2007) "The Technology of Skill Formation," *American Economic Review*, 97 (2), 31–47.

Cunha, Flavio, James J. Heckman, Lance Lochner, and Dimitriy V. Masterov (2006) "Chapter 12 Interpreting the Evidence on Life Cycle Skill Formation," 1 of Handbook of the Economics of Education, 697–812: Elsevier.

DeNeve, KM and H Cooper (1998) "The happy personality: a meta-analysis of 137 personality traits and subjective well-being," *Psychological Bulletin*, 124 (2), 197–229.

East, Chloe N., Sarah Miller, Marianne Page, and Laura R. Wherry (2023) "Multigenerational Impacts of Childhood Access to the Safety Net: Early Life Exposure to Medicaid and the Next Generation's Health," *American Economic Review*, 113 (1), 98–135.

Ferreira, Francisco H. G. and Norbert Schady (2009) "Aggregate Economic Shocks, Child Schooling, and Child Health," *The World Bank Research Observer*, 24 (2), 147–181.

Financial Times (2018) "Crop uncertainty drives vanilla price back to record level," March 25.

Hansen, Julie Hjerl, Peter Lykke Lind, and Amalie Linde (2016) "The Hidden Cost of Vanilla: Child Labour and Debt Spirals," Danwatch.

Haushofer, Johannes and Jeremy Shapiro (2016) "The Short-term Impact of Unconditional Cash Transfers to the Poor: Experimental Evidence from Kenya," *The Quarterly Journal of Economics*, 131 (4), 1973–2042.

Hidrobo, Melissa, Naureen Karachiwalla, and Shalini Roy (2020) "The impacts of cash transfers on mental health and investments: Experimental evidence from Mali."

Hills, Peter and Michael Argyle (2001) "Emotional stability as a major dimension of happiness," *Personality and Individual Differences*, 31 (8), 1357–1364.

INSTAT (2019) "Madagascar Enquête par grappes à indicateurs multiples, 2018. Rapport des résultats de l'enquête," Institut National de la Statistique (INSTAT) and Fonds des Nations Unies pour l'Enfance (UNICEF.

Jedwab, Remi, Paul Romer, Asif Islam, and Roberto Samaniego (forthcoming) "Human Capital Accumulation at Work: Estimates for the World and Implications for Development," *American Economic Journal: Macroeconomics*.

Kaila, Heidi, David E Sahn, and Naveen Sunder (2023) "Starting Strong: Investigating the Importance of Early Academic Performance for Adult Human Capital," *Journal of African Economies*, ejad018.

Kebede, Hundanol A (2021) "The Pass-Through of International Commodity Price Shocks to Producers' Welfare: Evidence from Ethiopian Coffee Farmers," *The World Bank Economic Review*, 36 (2), 305–328.

Knapp, Kenneth R, Michael C Kruk, David H Levinson, Howard J Diamond, and Charles J Neumann (2010) "The international best track archive for climate stewardship (IBTrACS) unifying tropical cyclone data," *Bulletin of the American Meteorological Society*, 91 (3), 363–376.

Kruger, Diana I. (2007) "Coffee production effects on child labor and schooling in rural Brazil," *Journal of Development Economics*, 82 (2), 448–463.

Mani, Anandi, Sendhil Mullainathan, Eldar Shafir, and Jiaying Zhao (2013) "Poverty Impedes Cognitive Function," *Science*, 341 (6149), 976–980.

Marina, Marie-France, Catherine Lord, Julie Andrews, Robert-Paul Justera, Shireen Sindi, and Genevieve Arsenault-Lapierrea (2011) "Chronic stress, cognitive functioning and mental health," *Neurobiology of learning and memory (Print)*, 96 (4), 583–595.

Martin, Dominic Andreas, Fanilo Andrianisaina, Thio Rosin Fulgence, Kristina Osen, Anjaharinony Andry Ny Aina Rakotomalala, Estelle Raveloaritiana, Marie Rolande Soazafy, Annemarie Wurz, Rouvah Andriafanomezantsoa, Harilala Andriamaniraka et al. (2022) "Land-use trajectories for sustainable land system transformations: Identifying leverage points in a global biodiversity hotspot," *Proceedings of the National Academy of Sciences*, 119 (7), e2107747119.

McEwen, Bruce S and Robert M Sapolsky (1995) "Stress and cognitive function," *Current Opinion in Neurobiology*, 5 (2), 205–216.

McManus, E, D Talmi, H Haroon, and N Muhlert (2022) "Psychosocial stress has weaker than expected effects on episodic memory and related cognitive abilities: A meta-analysis," *Neuroscience and biobehavioral reviews*, 132, 1099–1113.

Mekasha, Tseday J., Kiflu G. Molla, Finn Tarp, and Jehovaness Aikaeli (2022) "Commodity price fluctuations and child malnutrition," *World Development*, 158, 105927.

Merckaert, Jean (2022) "Côte d'Ivoire: Bitter Chocolate," in *On the Trail of Capital Flight from Africa: The Takers and the Enablers*: Oxford University Press.

Miller, Grant and B. Piedad Urdinola (2010) "Cyclicality, Mortality, and the Value of Time: The Case of Coffee Price Fluctuations and Child Survival in Colombia," *Journal of Political Economy*, 118 (1), 113–155.

Nestlé (2015) "Nestlé USA to Remove Artificial Flavors and FDA-Certified Colors," April 20.

Ohrnberger, Julius, Eleonora Fichera, Matt Sutton, and Laura Anselmi (2020) "The worse the better? Quantile treatment effects of a conditional cash transfer programme on mental health," *Health Policy and Planning*, 35 (9), 1137–1149.

O'Reilly, Finbarr (2018) "Precious as Silver, Vanilla Brings Cash and Crime to Madagascar," September 4.

Plant Village (2022) "Penn State University Plant Village Project Infopage," https://plantvillage.psu.edu/topics/vanilla/infos.

Reel, Monte (2019) "Watching global market forces at work in the far reaches of Madagascar," December 17.

Romero, Jimena, Kristina Esopo, Joel McGuire, and Johannes Haushofer (2021) "The Effect of Economic Transfers on Psychological Well-Being and Mental Health," Working Paper.

Sahn, David E and David Stifel (2003) "Exploring alternative measures of welfare in the absence of expenditure data," *Review of income and wealth*, 49 (4), 463–489.

Sahn, David E. and Kira Villa (2016) "Labor Outcomes during the Transition from Adolescence to Adulthood: The Role of Personality, Cognition, and Shocks in Madagascar," IZA Discussion Paper No. 10359.

Shields, Grant S, Matthew A Sazma, Andrew M McCullough, and Andrew P Yonelinas (2017) "The effects of acute stress on episodic memory: A meta-analysis and integrative review.," *Psychological bulletin*, 143 (6), 636.

Shriver, Jefferson (2013) "Revitalizing Vanilla in Madagascar. Report on a Feasibility Study to Enhance Small Farmer Participation in the Vanilla Value Chain," Catholic Relief Services, Baltimore, MD.

Steavenson, Wendell (2019) "Vanilla Boom Is Making People Crazy Rich—And Jittery—In Madagascar," September 15.

Tennant, Elizabeth and Elisabeth A. Gilmore (2020) "Government effectiveness and institutions as determinants of tropical cyclone mortality," *Proceedings of the National Academy of Sciences*, 117 (46), 28692–28699.

Uribe-Castro, Mateo (2021) "Caffeinated Development: Exports, Human Capital, and Structural Transformation in Colombia."

Willoughby, HE, RWR Darling, and ME Rahn (2006) "Parametric representation of the primary hurricane vortex. Part II: A new family of sectionally continuous profiles," *Monthly weather review*, 134 (4), 1102–1120.

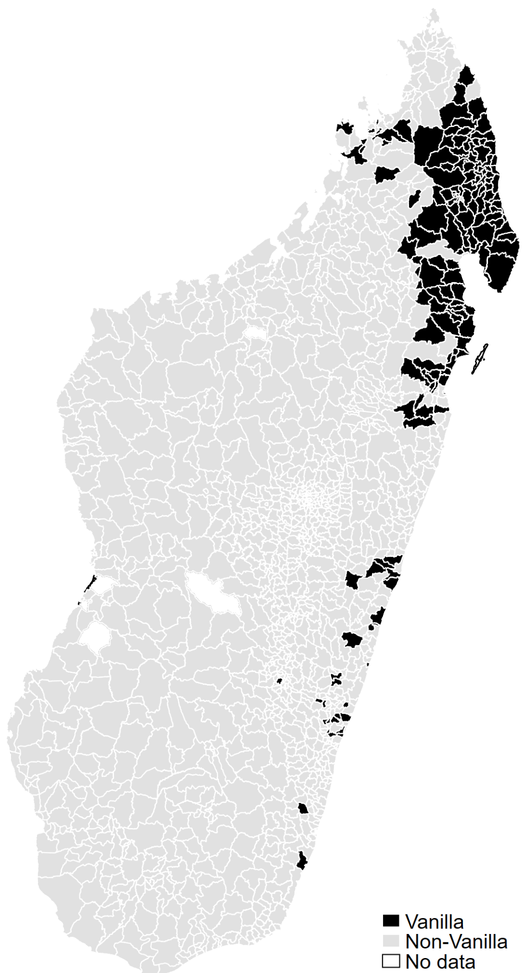
Winzer, Regina, Marjan Vaez, Lene Lindberg, and Kimmo Sorjonen (2021) "Exploring associations between subjective well-being and personality over a time span of 15–18 months: a cohort study of adolescents in Sweden," *BMC psychology*, 9 (1), 1–10.

World Bank (2023a) "Database," www.data.worldbank.org.

——— (2023b) "Poverty and Equity Brief: Madagascar," April 2023.

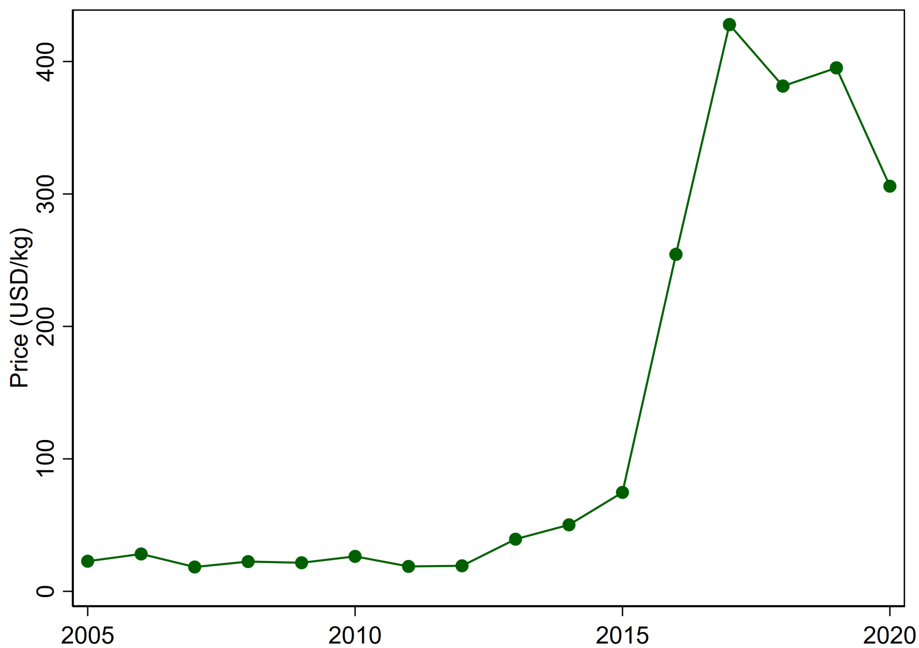
Zimmerman, Annie et al. (2021) "The impact of cash transfers on mental health in children and young people in low-income and middle-income countries: A systematic review and meta-analysis," *BMJ Global Health*, 6 (4).

Figure 1 – Vanilla-producing communes in Madagascar



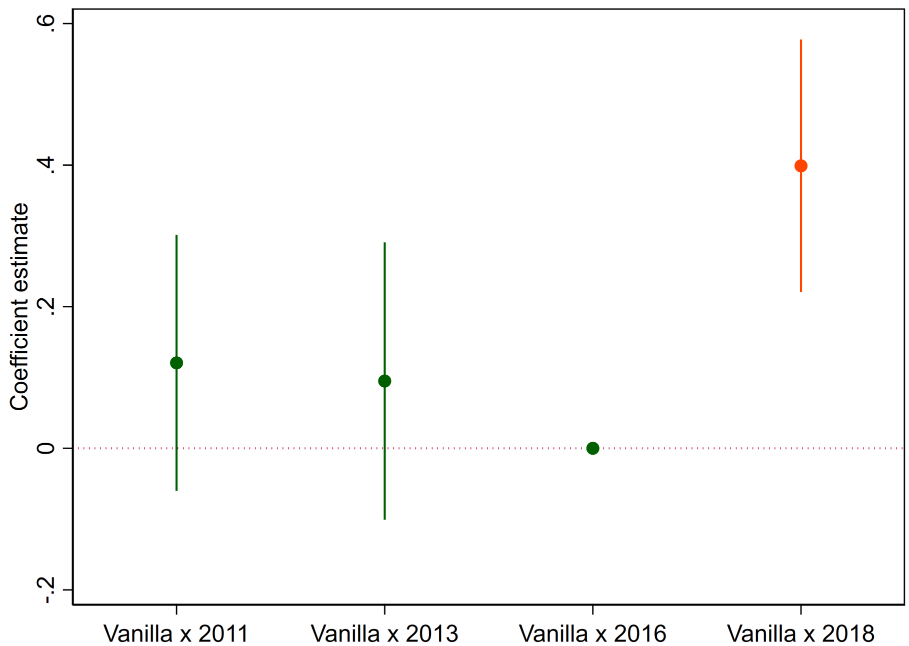
Notes: The figure displays the geographic distribution of vanilla production. Vanilla-producing communes are shown in black, based on data from a 2007 commune census. We define a commune as vanilla-producing if vanilla is among the five most common crops produced in the community, either measured by the land size devoted to vanilla production, or in terms of income generated.

Figure 2 – Global vanilla price



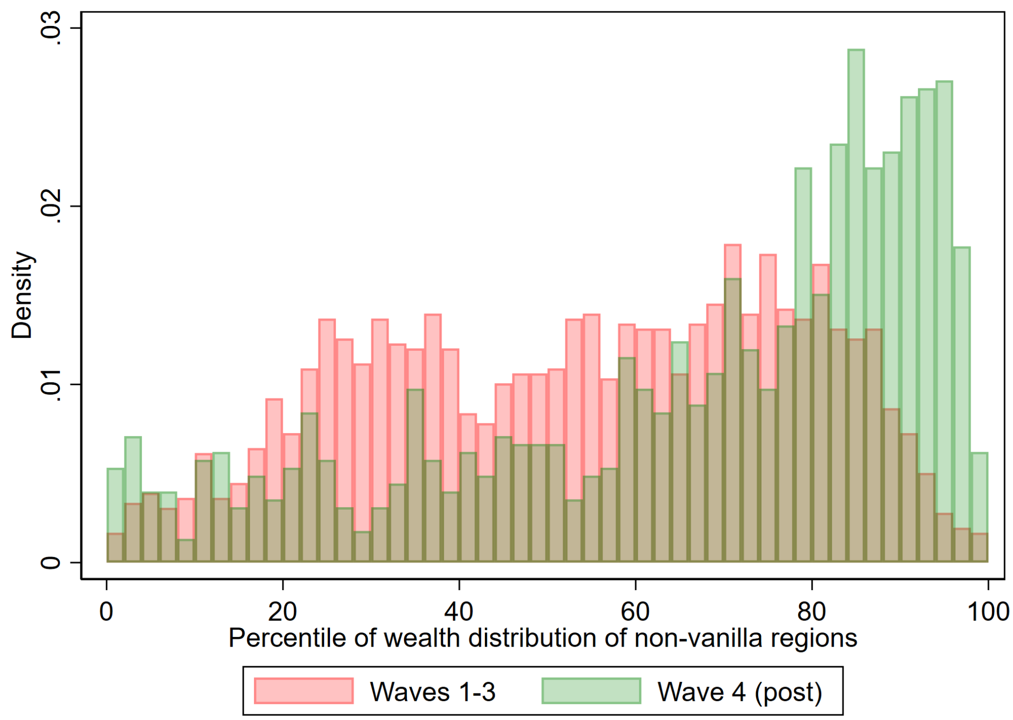
Notes: Data used is the COMTRADE database. Graph based on authors' calculations for the average value of a kilogram of vanilla exported from Madagascar at the annual level for 2005-2020 expressed in USD.

Figure 3 – Wealth index in vanilla-producing regions relative to non-vanilla regions



Notes: Data used is the MIS & MICS 4-wave repeated cross section; includes rural and urban households. The figure displays estimates of the average household wealth index in vanilla-growing communes relative to non-vanilla areas over time. The specification includes interactions between a vanilla-commune indicator and survey-year fixed effects, vanilla-commune × district fixed effects, and a set of household-level controls: age of the respondent, dummies for catholic, protestant, and no religion, number of births given by the mother, a dummy indicating whether the household resides in a rural community, and a dummy for household head being illiterate. Each marker represents the point estimate and 95% confidence interval from the vanilla-commune × survey-year fixed effect, except year 2016, which is the reference year. Population weights are used in the regression. Standard errors are adjusted for clustering at the district level.

Figure 4 – Distribution of household wealth in vanilla-growing regions before and after the vanilla price shock

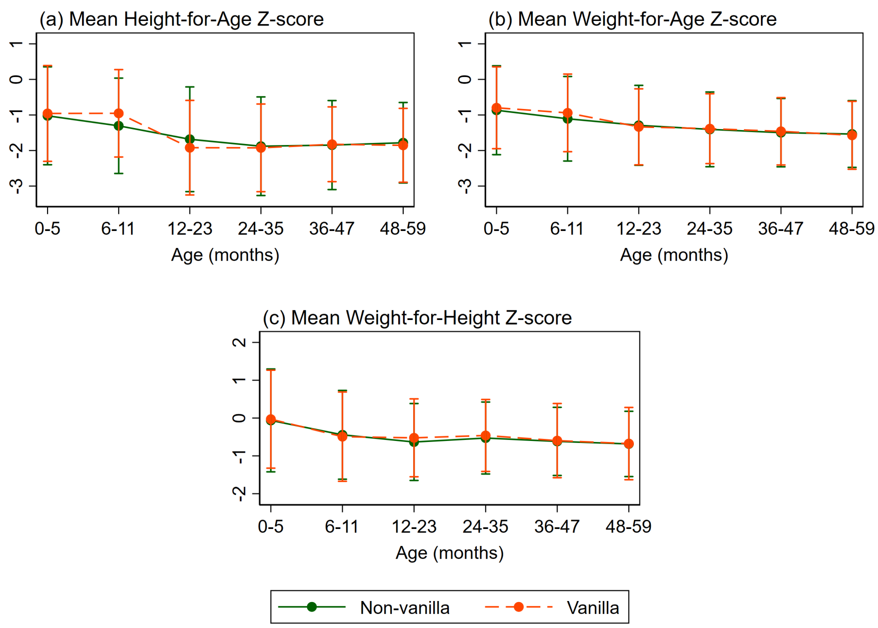


Notes: Data used is the MIS & MICS 4-wave repeated cross section; rural sample only. For each household residing in a vanilla-growing commune, we compare the value of their wealth index to households living in non-vanilla-growing communes to determine their corresponding position in the non-vanilla wealth distribution. The figure plots the histograms of this relative wealth measure for vanilla-growing areas prior to the price increase (Waves 1-3) and after the price increase (Wave 4). After the price increase, there is a large shift to the right in the wealth distribution for vanilla-growing areas relative to non-vanilla areas.

Figure 5 – Perceptions of economic well-being in vanilla-producing regions: selected outcomes

Notes: Data used is the Afrobarometer survey rounds 4 through 7; rural sample only. Each figure displays the point estimates and 95% confidence intervals from the interaction between an indicator for vanilla-growing commune and survey-year fixed effects. The outcome variable for the specification is indicated in each panel. "Own living conditions not bad?" equals 1 for respondents who rated their own present living conditions as *very good*, *fairly good*, or *neither good nor bad*, as opposed to *fairly bad* or *very bad*. "Country economic conditions not bad?" is coded the same way, in response to a questions about the present economic conditions in this country. "Country economic conditions vs. 12 mo ago?" is an indicator equaling 1 if the respondent answered *same*, *better*, or *much better* to the following question: "Looking back, how do you rate economic conditions in this county compared to twelve months ago?"; it is 0 if the response is *worse* or *much worse*. "Country economic conditions in 12 mo time?" is coded similarly, in response to the question: "Looking ahead, do you expect economic conditions in this country to be better or worse in twelve months time?"

Figure 6 – Child anthropometry in vanilla-growing and non-vanilla-growing regions



Notes: Data used is the MICS 2018 survey; rural sample only. The figures display average Z-scores by age group for children living in vanilla communes and non-vanilla communes; error bars indicate +/- 1 standard deviation.

Table 1 – Wealth of vanilla producers

	(1)	(2)	(3)
Panel A. Full Sample			
Vanilla producer × post	0.444***	0.438**	0.451***
	(0.167)	(0.179)	(0.167)
Vanilla producer	-0.298**	-0.333***	
	(0.113)	(0.0927)	
N	4113	3723	4099
R-Squared	0.333	0.373	0.620
Panel B. Restrict to vanilla communes			
Vanilla producer × post	0.540***	0.545***	0.538***
	(0.168)	(0.182)	(0.168)
Vanilla producer	-0.307**	-0.387***	
	(0.121)	(0.121)	
N	872	805	872
R-Squared	0.398	0.441	0.620
Panel C. Restrict to agricultural households			
Vanilla producer × post	0.442**	0.426**	0.446***
	(0.168)	(0.179)	(0.168)
Vanilla producer	-0.222**	-0.279***	
	(0.103)	(0.0891)	
N	3185	2933	3179
R-Squared	0.285	0.323	0.579
Panel D. IV, restrict to agricultural households			
Vanilla producer × post	0.850***	0.864***	0.835***
	(0.179)	(0.199)	(0.184)
Vanilla producer	-1.677	-1.071	
	(2.149)	(1.546)	
N	2520	2326	2520
R-Squared	-0.105	0.037	0.008
Controls	No	Yes	No
Zone FEs	Yes	Yes	No
Wave FE	Yes	Yes	Yes
Household FEs	No	No	Yes

Notes: Data used is the 3-wave DEMTREND cohort panel for the years 2003, 2012, and 2019. The dependent variable is the household asset index. "Vanilla producer" is a household-level indicator of vanilla production, and "Post" is an indicator for wave 3. Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2 – Wealth in vanilla-producing regions

	Full sample		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
Vanilla commune × post	0.356***	0.340***	0.282***	0.274***	0.455	0.387
	(0.0991)	(0.0653)	(0.0696)	(0.0642)	(0.287)	(0.242)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes
N	43040	43040	32465	32465	10575	10575

Notes: Data used is the MIS & MICS 4-wave repeated cross section; includes rural and urban households. The dependent variable is the household asset index. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census, and "Post" is an indicator for the fourth round of data in 2018. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3 – Financial outcomes of vanilla producers

	Formal savings	Informal savings	Loans	Received remittances	Sent remittances
	(1)	(2)	(3)	(4)	(5)
Panel A. Full Sample					
Vanilla producer × post	-0.0487	0.372***	-0.0662	-0.103***	-0.0373
	(0.139)	(0.0813)	(0.0915)	(0.0330)	(0.0471)
N	4224	4224	4224	4224	2640
R-Squared	0.478	0.427	0.435	0.398	0.572
Panel B. Restrict to vanilla communes					
Vanilla producer × post	-0.0848	0.285***	-0.00108	-0.109***	-0.0845
	(0.142)	(0.0829)	(0.0910)	(0.0369)	(0.0590)
N	877	877	877	877	558
R-Squared	0.451	0.508	0.524	0.405	0.574
Panel C. Restrict to agricultural households					
Vanilla producer × post	-0.0574	0.384***	-0.0761	-0.116***	-0.0415
	(0.138)	(0.0816)	(0.0912)	(0.0340)	(0.0488)
N	3269	3269	3269	3269	2086
R-Squared	0.474	0.440	0.427	0.368	0.573
Panel D. IV, restrict to agricultural households					
Vanilla producer × post	-0.284	0.760***	-0.275	-0.174***	-0.0353
	(0.245)	(0.131)	(0.188)	(0.0526)	(0.0950)
N	2520	2520	2520	2520	1620
R-Squared	-0.007	-0.000	-0.008	0.003	0.000
Wave FE	Yes	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	Yes	Yes

Notes: Data used is the DEMTREND cohort panel. The dependent variables are indicators defined as follows: "Formal savings" indicates the household has an account with any type of bank, life insurance company, or a micro finance institution; "Informal savings" indicates savings in an informal institution, an association, or at home; "Loans" indicates whether the household has a loan that they have not paid back in full from any kind of bank, friends, neighbors, family members, business partners or employers informal credit associations or anywhere else, excluding in-kind loans; "Received remittances" indicates whether the household or any of its members has received money or goods from individuals outside the household in the last 12 months; and "Sent remittances" indicates whether the household or any of its members have made a similar transfer to someone outside of the household. Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 – Perceptions of economic well-being in vanilla-producing regions

		Economic conditions in the country		
	(1) Own living conditions	(2) Current	(3) Compared to 12 months ago	(4) In 12 months
Vanilla commune × post	0.274***	0.419**	0.395***	0.339***
	(0.104)	(0.163)	(0.117)	(0.0891)
District × vanilla FEs	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes
Observations	3715	3560	3563	3087

Notes: Data used is the Afrobarometer survey; rural sample only. See notes to Figure 5 for descriptions of dependent variables. "Post" is an indicator for the 2018 round of data. Control variables include dummies for age categories and gender of the respondent. Population weights are used in the regressions. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 – Psychological well-being and cognitive test scores of vanilla producers

	Emotional Stability		Cognitive Tests	
	(1) Average	(2) Factor	(3) French	(4) Math
Panel A. Full Sample				
Vanilla producer × post	0.208*	0.379*	0.0249	0.0731***
	(0.107)	(0.213)	(0.0336)	(0.0255)
N	2366	2366	2386	2386
R-Squared	0.505	0.510	0.760	0.735
Panel B. Vanilla Communes				
Vanilla producer × post	0.222*	0.384	0.00420	0.0519**
	(0.115)	(0.231)	(0.0439)	(0.0215)
N	464	464	514	514
R-Squared	0.514	0.522	0.784	0.754
Panel C. Restrict to agricultural households				
Vanilla producer × post	0.215**	0.386*	0.0130	0.0663**
	(0.107)	(0.213)	(0.0352)	(0.0265)
N	1862	1862	1844	1844
R-Squared	0.507	0.513	0.745	0.725
Panel D. IV, restrict to agricultural households				
Vanilla producer × post	0.614***	1.111***	0.114	0.130*
	(0.199)	(0.344)	(0.0871)	(0.0749)
N	1436	1436	1438	1438
R-Squared	-0.011	-0.010	-0.007	0.001
Wave FE	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	Yes

Notes: Data used is the DEMTREND cohort panel. The dependent variables in columns 1 and 2 are measures of psychological well-being based on the numerical responses (from 1 to 5) to 19 questions related to "emotional stability" from the non-cognitive (Big Five) questionnaire (listed in Table A10): column 1 uses the simple average across all 19 questions, while column 2 uses the first factor from confirmatory factor analysis; higher values indicate higher levels of "emotional stability" or, equivalently, lower levels of "neuroticism". The dependent variable in the final two columns is the average of the cohort member's score across the oral and written tests in French (column 3) or math (column 4). Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 – Antenatal care and female education in vanilla-producing regions

	Female Education		Received ANC			IPTp	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Years	Literacy	Any	Formal	Informal	Any	2 or more
Vanilla commune × post	0.0505	0.0110	-0.0293	-0.0223	-0.00122	-0.0963	-0.109**
	(0.397)	(0.0426)	(0.0337)	(0.0391)	(0.0154)	(0.0702)	(0.0517)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	7463	7463	10303	10303	10303	15033	14998

Notes: Data used is the MIS & MICS 4-wave repeated cross section; rural sample only. The dependent variables are the years of completed education and literacy for women 15-19 years of age, any antenatal care while pregnant, and dummies for formal or informal antenatal care while pregnant. IPTp refers to the administration of a dose of an antimalarial drug to a pregnant woman. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. "Post" takes value one for the fourth round of the data 2018. Wave FEs include dummies for years 2011, 2013 and 2018. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7 – Wealth of vanilla producers and non-producers

	(1)	(2)	(3)
Panel A. Full Sample			
Vanilla commune × producer × post	0.649***	0.637***	0.642***
	(0.158)	(0.180)	(0.163)
Vanilla commune × non-producer × post	0.0266	0.0708	0.0185
	(0.186)	(0.193)	(0.186)
Vanilla producer	-0.344*	-0.388**	
	(0.198)	(0.173)	
N	3162	2893	3162
R-Squared	0.388	0.415	0.629
Panel C. Restrict to agricultural households			
Vanilla commune × producer × post	0.656***	0.634***	0.648***
	(0.157)	(0.179)	(0.161)
Vanilla commune × non-producer × post	0.173*	0.220**	0.177*
	(0.0996)	(0.0960)	(0.0992)
Vanilla producer	-0.184	-0.270**	
	(0.150)	(0.125)	
N	2491	2299	2491
R-Squared	0.325	0.357	0.590
Controls	No	Yes	No
Zone FEs	Yes	Yes	No
Wave FE	Yes	Yes	Yes
Household FEs	No	No	Yes

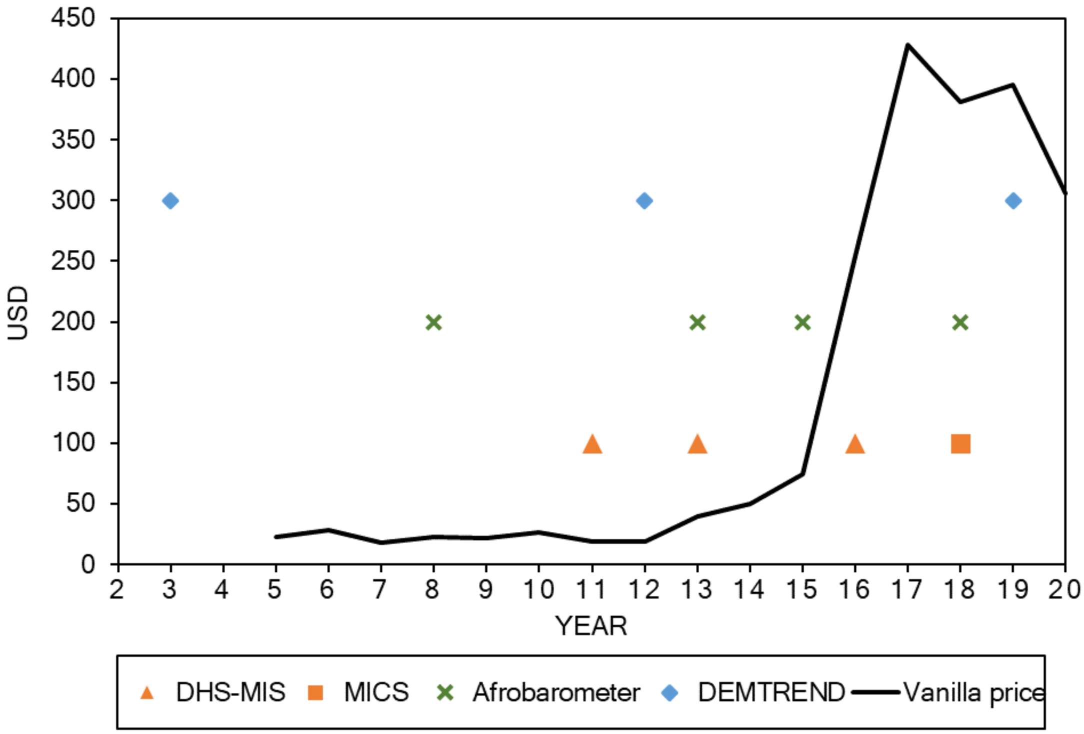
Notes: Data used is the DEMTREND cohort panel. The dependent variable is the household asset index, standardized by the mean and standard deviation of all non-vanilla producing households. "Vanilla Communes" refers to the communes where vanilla was listed as one of the top-5 crops in the 2007 commune census. The zone FEs include fixed effects for the zones from both wave 1 and wave 3. Robust standard errors in parentheses, adjusted for two-way clustering on zone in wave 1 and zone in wave 3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix for:

Posh spice or scary spice? Resource booms, wealth, and human capital across ages

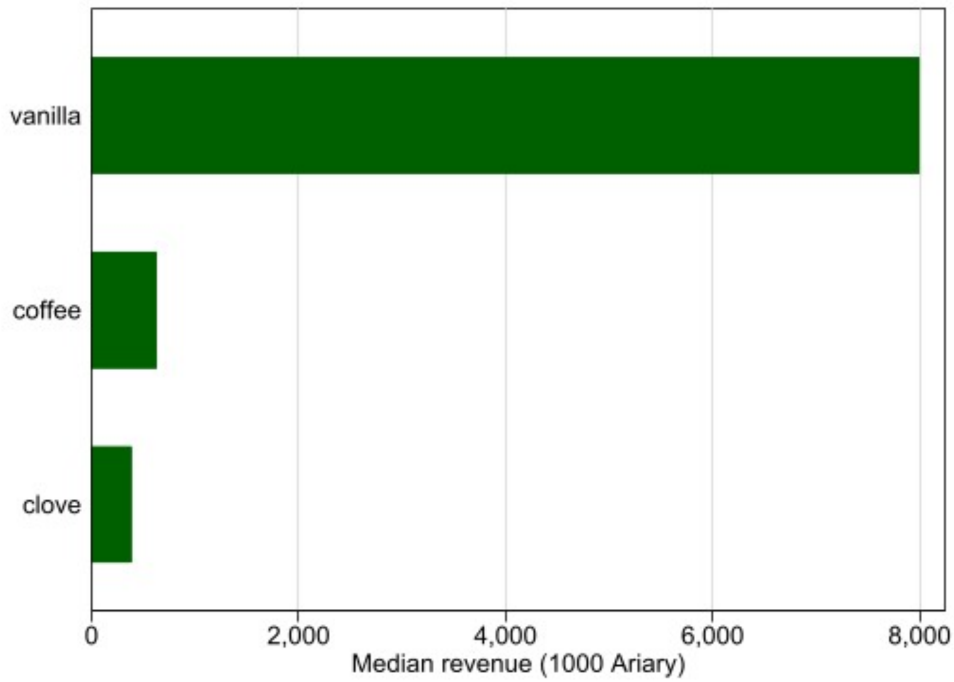
A Additional Figures and Tables

Figure A1 – Survey timing and vanilla price



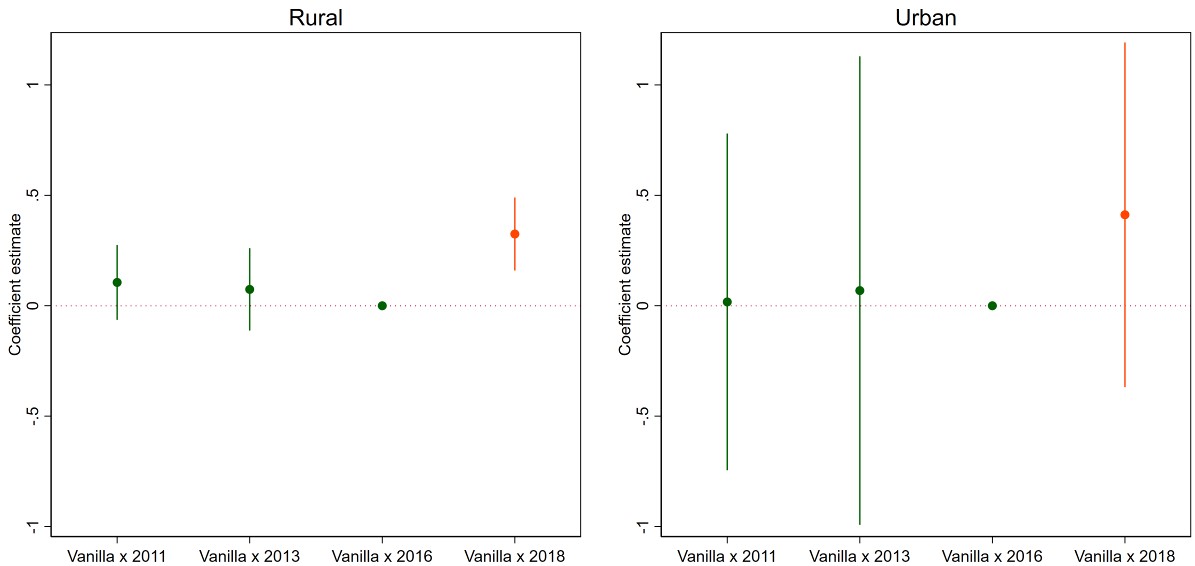
Notes: Timing of survey data used for analysis. X-axis displays the year of the vanilla price and survey year. Y-axis displays the vanilla price from the COMTRADE database. Graph based on authors' calculations for the average value of a kilogram of vanilla exported from Madagascar at the annual level for 2005-2020 expressed in USD.

Figure A2 – Median revenue of cash crop producers



Notes: Data used is the DEMTREND dataset 2019 wave. Median revenue for each crop is calculated among the households producing that crop and expressed in 1000 Ariary. The median revenue of vanilla crop in the previous 12 months before the 2019 survey was 8,000,000 Ariary, which corresponds to USD 7,131.60 (in 2019 PPP).

Figure A3 – Wealth index in vanilla-producing regions relative to non-vanilla regions: rural and urban

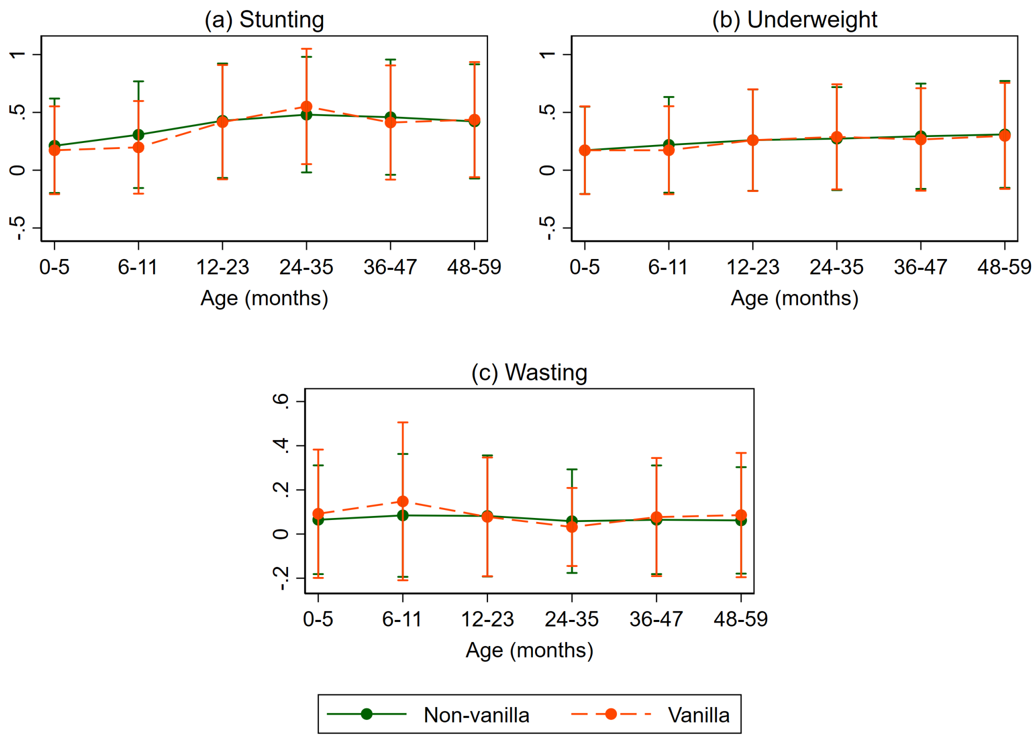


Notes: Data used is the MIS & MICS 4-wave repeated cross section. See notes to Figure 3, which displays the corresponding results for the combined sample.

Figure A4 – Girls' education in vanilla-growing regions

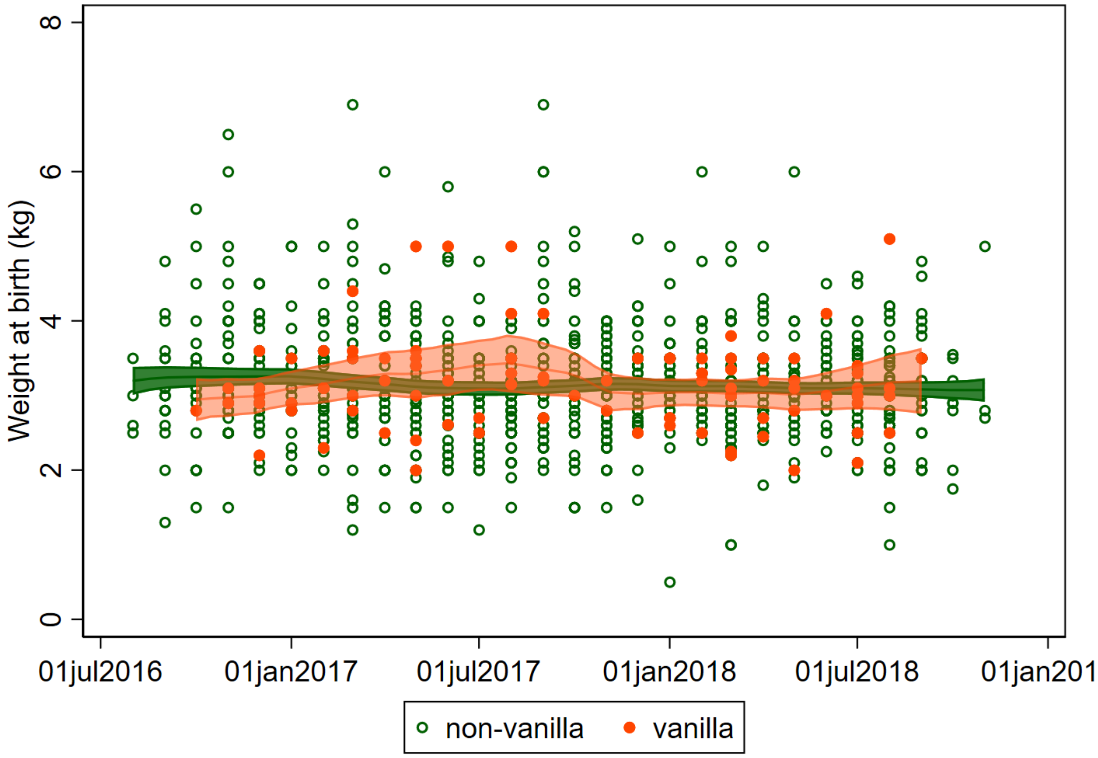
Notes: Data used is the MIS & MICS 4-wave repeated cross section; rural sample only. We regress years of education of women between 15-19 years of age on vanilla commune × survey year fixed effects, district × vanilla commune fixed effects, age × survey year fixed effects, and a set of household controls: dummies for catholic, protestant, and no religion, number of births given by the mother, a dummy indicating whether the household resides in a rural community, and a dummy for household head being illiterate. Each marker represents the point estimate from vanilla commune × survey year fixed effect, except year 2016, which is the reference year. The figure displays the point estimate and 95% confidence interval. Population weights are used in the regression. Standard errors are adjusted for clustering at the district level.

Figure A5 – Child malnutrition in vanilla-growing and non-vanilla-growing regions



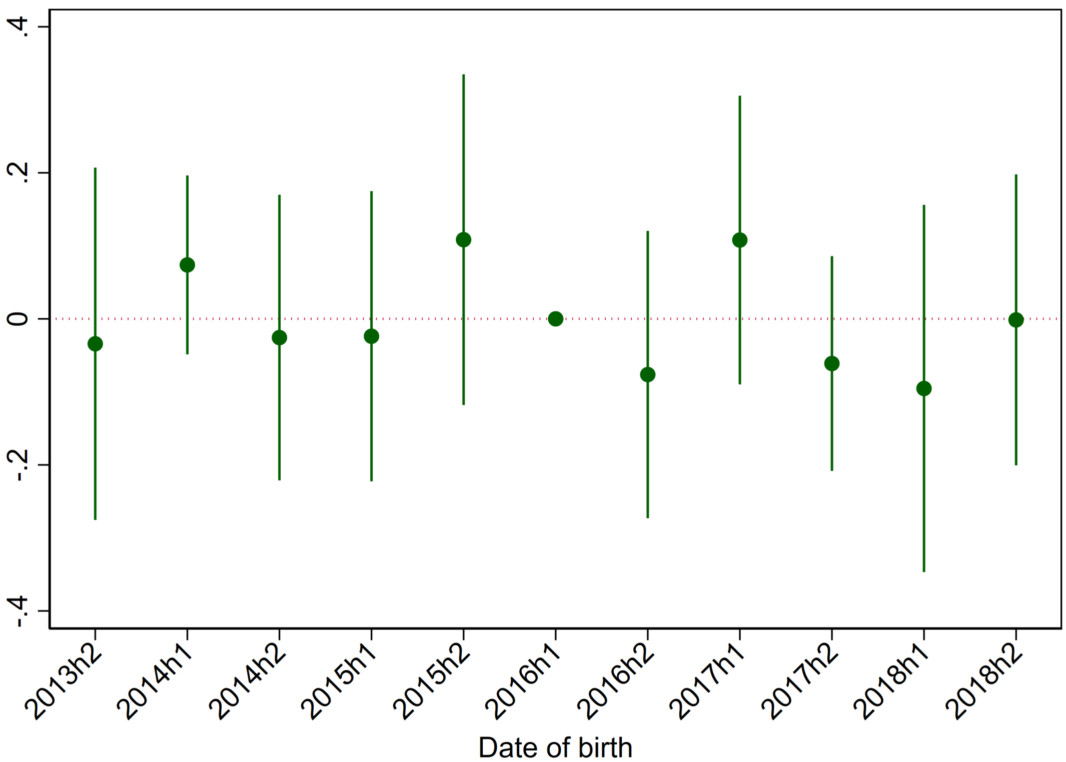
Notes: Data used is the MICS 2018 survey; rural sample only. The figures display average rates for three indicators of child malnutrition (stunting, wasting, and underweight) by age group for children living in vanilla communes and non-vanilla communes; error bars indicate +/- 1 standard deviation.

Figure A6 – Birth weight in vanilla-growing and non-vanilla-growing regions



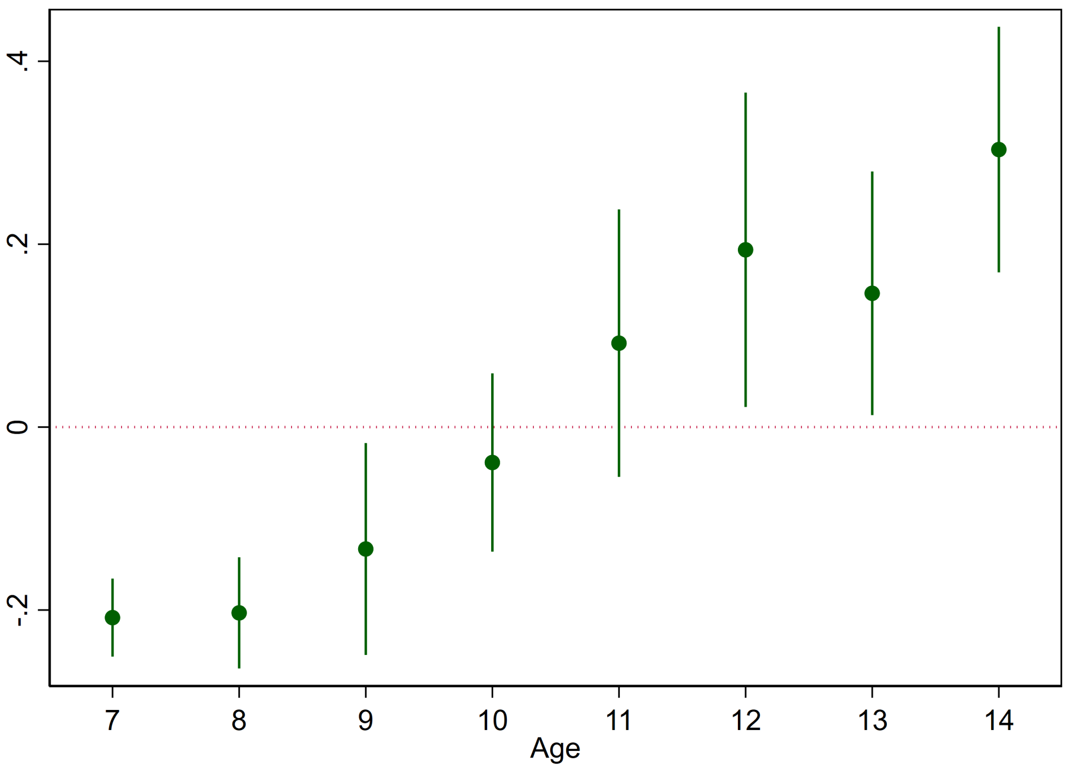
Notes: Data used is the MICS 2018 survey; rural sample only. The figure plots weight at birth by month of birth for children born in the last 2 years, separately for vanilla and non-vanilla communes. The lines display a local polynomial smooth with 95% confidence intervals.

Figure A7 – Retrospective panel: Child birth certificate status by date of birth



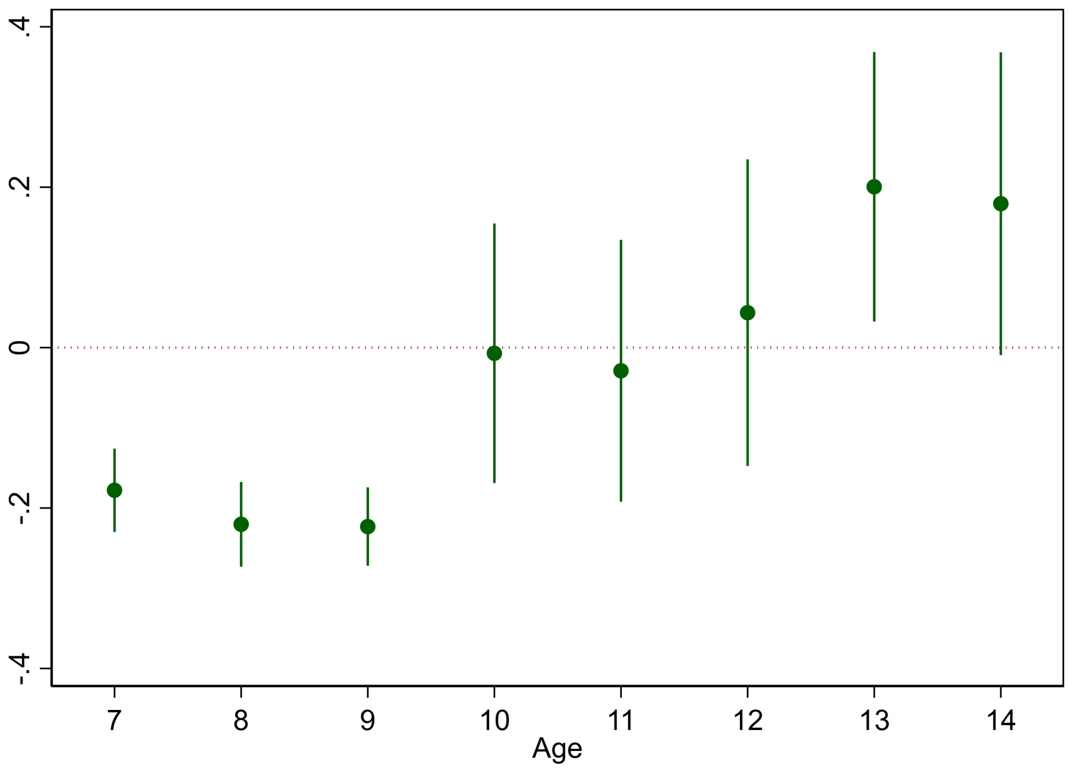
Notes: Data used is the MICS 2018 survey; rural sample only. The figure plots the coefficient estimates from the interaction between indicator variables representing the timing of birth and an indicator for whether the child resides in a vanilla-growing commune. Births are grouped into 6-month (i.e., half-year) increments. The outcome variable is an indicator for whether the child has a birth certificate. Estimates are relative to the base period of 2016H1.

Figure A8 – Math skills by age



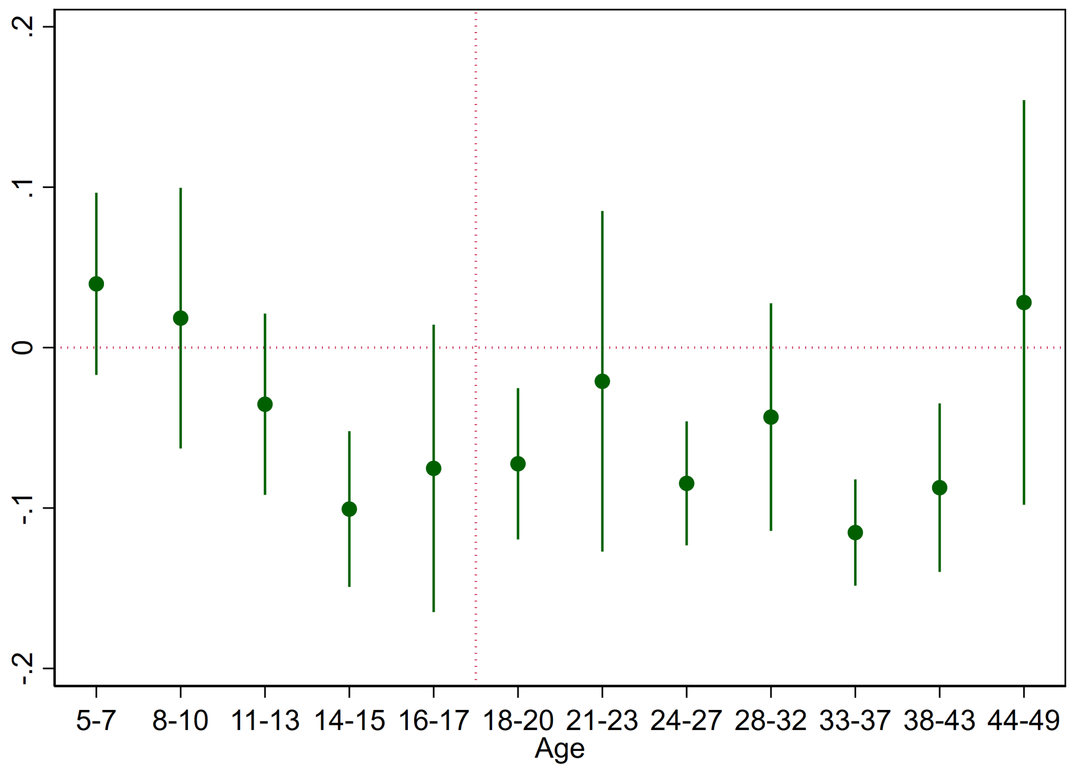
Notes: Data used is the MICS 2018 survey; rural sample only. The figure plots the coefficient estimates from the interaction between age fixed effects and an indicator for whether the child resides in a vanilla-growing commune. The dependent variable is the average of four questions in the MICS survey designed to test math skills.

Figure A9 – Reading skills by age



Notes: Data used is the MICS 2018 survey; rural sample only. The figure plots the coefficient estimates from the interaction between age fixed effects and an indicator for whether the child resides in a vanilla-growing commune. The dependent variable is a measure of child reading skills, based on whether the child can read a passage and correctly answer the corresponding reading comprehension questions.

Figure A10 – Functional difficulties by age



Notes: Data used is the MICS 2018 survey; rural sample only. The figure plots the coefficient estimates from the interaction between age fixed effects and an indicator for whether the child resides in a vanilla-growing commune. The dependent variable is an indicator for whether the individual is classified as having a disability based on the responses to questions designed to measure functional difficulties, which vary according to the age of the respondent. The child-level data sets are used for this analysis: the estimates for ages 5-17 correspond to the disability status of the child; the estimates for age 18 and over correspond to the disability status of the child's caretaker.

Table A1 – Summary statistics by wave: DEMTREND panel

	All years	2003		2012		2019	
	Pooled	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla
Asset index	-.026	.017	-.29	.025	-.39	-.044	.044
Formal savings	.18	.063	.079	.13	.17	.42	.4
Informal savings	.21	.14	.079	.33	.83	.12	.7
Loan	.14	.073	.032	.29	.42	.041	.016
Received remittances	.14	.098	.079	.22	.25	.11	.016
Sent remittances	.22	.	.	.28	.17	.15	0
Phone	.52	.	.	.5	.27	.57	.68
Motorcycle	.047	.0093	.016	.051	.017	.088	.32
Bicycle	.3	.31	.33	.32	.35	.29	.3
Television	.24	.16	.032	.3	.15	.34	.37
Radio	.59	.5	.38	.64	.87	.7	.78
Fridge freezer	.045	.033	0	.052	.017	.068	.016
Currently working	.83	.	.	.77	.86	.89	.9
Worked in the last 7 days	.76	.	.	.69	.83	.82	.75
Worked in the last 12 months	.84	.	.	.78	.86	.9	.92
Total hours spent in employment in the last 12 months	1084	.	.	866	673	1331	1299
Has an agriculture/livestock occupation	.59	.	.	.67	.92	.48	.97
Number of hours spent in the last 12 months doing agriculture	516	.	.	515	596	459	1183
Minutes per day devoted to all six unpaid work	196	.	.	210	191	165	93
French score	.49	.	.	.46	.34	.56	.47
Math score	.41	.	.	.42	.31	.42	.38
Emotional stability (average)	3.6	.	.	3.7	3.5	3.5	3.5
Emotional stability (factor analysis)	.016	.	.	.14	-.15	-.14	-.076
New Household	.36	0	0	.49	.43	.62	.71
Household size	5.2	6.9	6.7	5	5	3.7	3.1
Female household head 2012	.16	.16	.13	.16	.13	.16	.13
Highest grade in 2012	7.7	7.9	7.2	7.9	7.2	7.9	7.2
Height in 2012	160	160	160	160	160	160	160
Observations	5645	1391	63	1281	60	1391	63

Notes: Table displays means of selected variables from the DEMTREND cohort panel dataset, which consists of 3 waves (2003, 2012, and 2019). Statistics are displayed separately for vanilla-producing and non-vanilla-producing households.

Table A2 – Summary statistics by sample: DEMTREND panel

	Full sample		Vanilla communes		Agricultural households	
	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla
Asset index	1.0e-17	-.21	-.13	-.21	-.23	-.21
Formal savings	.21	.22	.21	.22	.18	.22
Informal savings	.2	.53	.23	.53	.19	.53
Loan	.13	.15	.15	.15	.12	.15
Received remittances	.14	.11	.097	.11	.12	.11
Sent remittances	.21	.081	.13	.081	.2	.081
Phone	.53	.48	.39	.48	.45	.48
Motorcycle	.048	.12	.055	.12	.035	.12
Bicycle	.3	.33	.29	.33	.3	.33
Television	.26	.18	.21	.18	.17	.18
Radio	.61	.67	.51	.67	.59	.67
Fridge freezer	.05	.011	.051	.011	.024	.011
Currently working	.83	.89	.85	.89	.88	.89
Worked in the last 7 days	.76	.79	.79	.79	.81	.79
Worked in the last 12 months	.84	.89	.86	.89	.89	.89
Total hours spent in employment in the last 12 months	1108	994	1036	994	1130	994
Has an agriculture/livestock occupation	.56	.94	.67	.94	.69	.94
Number of hours spent in the last 12 months doing agriculture	486	897	518	897	627	897
Minutes per day devoted to all six unpaid work	187	141	173	141	191	141
French score	.51	.4	.47	.4	.46	.4
Math score	.42	.35	.38	.35	.38	.35
Emotional stability (average)	3.6	3.5	3.5	3.5	3.6	3.5
Emotional stability (factor analysis)	1.5e-17	-.11	-.09	-.11	-.042	-.11
New Household	.38	.39	.4	.39	.36	.39
Household size	5.1	4.9	4.7	4.9	5.3	4.9
Female household head 2012	.16	.13	.22	.13	.14	.13
Highest grade in 2012	7.9	7.2	7.5	7.2	7.3	7.2
Height in 2012	160	160	160	160	159	160
Observations	4063	186	693	186	3092	186

Notes: Table displays means of selected variables from the DEMTREND cohort panel dataset with the three samples used for the analysis: full sample, sample restricted to vanilla communities, and sample restricted to agricultural households. Statistics are displayed as pooled across the three waves (2003, 2012, and 2019).

Table A3 – Summary statistics by wave: MIS and MICS

	All years	2011		2013		2016		2018	
	Pooled	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla
Asset index	.063	.09	.027	.095	-.019	.079	-.16	-.056	.19
Mobile phone	.43	.37	.31	.37	.33	.39	.32	.48	.58
Motorcycle	.049	.047	.024	.051	.058	.051	.053	.039	.12
Car	.02	.031	.017	.029	.018	.015	.0099	.012	.014
Radio	.52	.57	.62	.54	.52	.52	.54	.46	.57
Bicycle	.2	.24	.24	.23	.21	.2	.15	.18	.15
Watch	.35	.44	.31	.4	.32	.37	.28	.25	.28
Bank Account	.094	.13	.13	.1	.083	.096	.063	.061	.07
Finished Roof	.38	.4	.44	.41	.47	.37	.38	.32	.53
Protected water source	.43	.47	.31	.47	.4	.48	.23	.37	.32
Piped water	.25	.31	.15	.25	.21	.28	.093	.19	.16
Toilet with any Facility	.54	.47	.69	.49	.53	.61	.68	.52	.58
Age of the mother	28	28	28	29	28	28	28	28	28
Religion: Catholic	.33	.33	.28	.35	.44	.33	.26	.3	.33
Religion: Protestant	.32	.34	.39	.33	.24	.34	.25	.3	.28
Religion: NO	.18	.27	.19	.23	.24	.23	.39	.071	.1
Religion: Others	.18	.061	.14	.091	.085	.1	.096	.32	.29
Number of births	2.6	2.9	2.8	2.8	2.1	2.6	2.6	2.6	2.1
Living in rural area	.74	.73	.71	.73	.69	.8	.89	.73	.81
Household head illiterate	.28	.3	.24	.29	.19	.28	.33	.29	.25
Observations	45681	7628	478	7318	639	9494	1130	16426	1493

Notes: MIS & MICS 4-wave repeated cross section has 3 waves of DHS-MIS data from years 2011, 2013, and 2016, and MICS data from 2018. Means are displayed separately for vanilla communes and non-vanilla communes.

Table A4 – Summary statistics by wave: MIS and MICS rural sample

	All years	2011		2013		2016		2018	
	Pooled rural	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla
Asset index	-.28	-.3	-.26	-.3	-.36	-.21	-.31	-.33	-.022
Mobile phone	.32	.23	.13	.23	.19	.3	.27	.41	.53
Motorcycle	.025	.017	.006	.023	.0092	.03	.036	.02	.093
Car	.01	.016	.006	.017	.0023	.0091	.004	.0066	.0075
Radio	.46	.48	.61	.47	.45	.48	.52	.41	.54
Bicycle	.18	.2	.16	.19	.17	.18	.13	.17	.11
Watch	.26	.35	.26	.3	.22	.31	.24	.19	.22
Bank Account	.041	.062	.056	.045	.034	.048	.035	.026	.03
Finished Roof	.26	.25	.37	.28	.4	.26	.35	.22	.48
Protected water source	.32	.32	.25	.33	.27	.41	.17	.29	.27
Piped water	.13	.14	.11	.11	.13	.18	.067	.11	.14
Toilet with any Facility	.46	.36	.58	.37	.48	.56	.67	.47	.55
Age of the mother	28	28	29	29	28	28	28	28	28
Religion: Catholic	.3	.28	.23	.31	.37	.32	.24	.29	.3
Religion: Protestant	.31	.33	.42	.32	.25	.33	.25	.29	.27
Religion: NO	.21	.36	.24	.29	.3	.26	.43	.057	.084
Religion: Others	.19	.034	.11	.069	.081	.093	.089	.37	.34
Number of births	2.9	3.2	3.2	3.1	2.1	2.8	2.7	2.8	2.2
Living in rural area	1	1	1	1	1	1	1	1	1
Household head illiterate	.34	.38	.3	.37	.22	.32	.35	.34	.27
Observations	33704	5559	337	5323	444	7633	1008	12058	1207

Notes: MIS & MICS 4-wave repeated cross section has 3 waves of DHS-MIS data from years 2011, 2013, and 2016, and MICS data from 2018. The sample here is restricted to rural enumeration areas only. Means are displayed separately for vanilla communes and non-vanilla communes.

Table A5 – Summary statistics by wave: Afrobarometer rural sample

	All years	2008		2013		2014		2018	
	Pooled	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla	Non-Vanilla	Vanilla
Female	.5	.5	.5	.5	.5	.5	.5	.5	.5
Own living conditions	.46	.58	.53	.44	.38	.35	.39	.44	.75
Country economic conditions	.41	.67	.63	.33	.3	.3	.35	.28	.69
Country econ conditions vs. 12 mos. ago	.53	.71	.59	.52	.54	.5	.46	.37	.73
Country econ conditions in 12 months	.68	.83	.65	.75	.76	.64	.58	.56	.76
Often without food	.62	.59	.54	.65	.62	.63	.62	.63	.64
Often without water	.52	.36	.4	.57	.5	.64	.84	.51	.6
Often without medical care	.55	.54	.65	.51	.55	.49	.63	.62	.74
Often without cooking fuel	.28	.29	.32	.33	.14	.25	.29	.28	.26
Often without cash	.85	.8	.83	.85	.92	.84	.91	.9	.85
Piped water in enumeration area	.3	.23	.17	.36	.2	.36	.15	.31	.27
Sewage system in enumeration area	.028	.032	0	.021	0	.038	0	.038	0
Car or motorcycle	.043	.034	.028	.02	.017	.064	.058	.057	.024
Television	.14	.17	.13	.092	.017	.18	.13	.14	.19
Radio	.68	.71	.73	.64	.56	.73	.65	.62	.81
Mobile phone	.43	.	.	.	.	.41	.38	.44	.61
Observations	3806	888	106	760	120	840	104	832	88

Notes: Afrobarometer data used has 4 waves in 2008, 2013, 2014 and 2018. We restrict the data to rural enumeration areas. The variables "Own living conditions not bad?" and "Country economic conditions not bad?" equal 1 for respondents who answered *very good*, *fairly good*, or *neither good nor bad*, as opposed to *fairly bad* or *very bad*. "Country economic conditions vs. 12 mo ago?" an ".. in 12 mo time?"are indicators equaling 1 if the respondent answered *same*, *better*, or *much better*. The questions starting with "Often without ..." the respondent is asked, "Over the past year, how often, if ever, have you or anyone in your family gone without" each of the indicated necessities. The dependent variable is equal to 1 if the response is *several times*, *many times*, or *always*, and equal to 0 if *never* or *just once or twice*. Questions on assets and public infrastructure are all binary outcomes.

Table A6 – Wealth of vanilla producers: additional specifications using commune-level spatial variation

	(1)	(2)	(3)
Panel 1. Reduced form, restrict to agricultural households			
Vanilla commune × post	0.332**	0.337**	0.343**
	(0.163)	(0.161)	(0.163)
Vanilla commune	0.0778	0.0321	
	(0.141)	(0.137)	
N	2947	2716	2943
R-Squared	0.293	0.329	0.582
Panel 2. Reduced form, full sample			
Vanilla commune × post	0.209	0.232	0.211
	(0.210)	(0.210)	(0.213)
Vanilla commune	0.0611	0.0131	
	(0.140)	(0.131)	
N	3741	3408	3732
R-Squared	0.347	0.382	0.623
Panel 3. IV, full sample			
Vanilla producer × post	0.702*	0.769**	0.692*
	(0.360)	(0.356)	(0.369)
Vanilla producer	-3.328	-2.040	
	(4.313)	(2.986)	
N	3191	2920	3191
R-Squared	-0.332	-0.039	0.007
Controls	No	Yes	No
Zone FEs	Yes	Yes	No
Wave FE	Yes	Yes	Yes
Household FEs	No	No	Yes

Notes: Data used is the DEMTREND cohort panel. Panel 1 presents the reduced form of the IV results displayed in Table 1 Panel D using the sample of agricultural households only. Panel 2 and Panel 3 display results of the reduced form and the second stage of an IV analysis, respectively, using the full sample. The dependent variable is the household asset index, standardized by the mean and standard deviation of all non-vanilla producing households. "Vanilla commune" here is an indicator for communes where vanilla was listed as one of the top-5 crops in the 2007 commune census. The IV specification in panel 3 instruments "vanilla producer" with the "vanilla commune" indicator. Control variables include household size, whether the household is new, female household head (in 2012), highest grade attained by the cohort member in 2012, and the cohort members height in 2012 in centimeters. Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7 – Asset poverty

	Rural sample	
	(1)	(2)
Vanilla commune × post	-0.0473**	-0.0461**
	(0.0209)	(0.0219)
District × vanilla FEs	Yes	Yes
Controls	No	Yes
Wave FEs	Yes	Yes
N	32465	32465

Notes: Data used is the MIS & MICS 4-wave repeated cross section; rural sample only. The dependent variable takes value one if the household's wealth index is below the 80.7^{th} percentile of the wealth distribution, a fraction equivalent to the share of the population living in poverty in Madagascar in 2012 (using the international poverty line of 2.15 USD per day in 2017 PPP). "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. "Post" takes value one for the fourth round of the data 2018. Wave FEs include dummies for years 2011, 2013 and 2018, such that 2016 round is used as the reference period. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8 – Assets of vanilla producers

	Mobile phone	Motorcycle	Bicycle	Television	Radio	Fridge freezer
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Full Sample						
Vanilla producer × post	0.336***	0.246**	-0.0124	0.162**	0.0370	-0.0154
	(0.0675)	(0.108)	(0.115)	(0.0800)	(0.0645)	(0.0180)
N	2438	4099	4099	4099	4099	4099
R-Squared	0.684	0.457	0.418	0.637	0.436	0.526
Panel B. Restrict to vanilla communes						
Vanilla producer × post	0.244***	0.239**	0.0143	0.204***	-0.0546	0.00254
	(0.0654)	(0.103)	(0.130)	(0.0746)	(0.0587)	(0.0227)
N	548	872	872	872	872	872
R-Squared	0.700	0.509	0.408	0.615	0.471	0.516
Panel C. Restrict to agricultural households						
Vanilla producer × post	0.314***	0.261**	-0.0427	0.179**	0.0381	-0.0125
	(0.0693)	(0.109)	(0.116)	(0.0800)	(0.0656)	(0.0176)
N	1930	3179	3179	3179	3179	3179
R-Squared	0.661	0.446	0.432	0.598	0.430	0.460
Panel D. IV, restrict to agricultural households						
Vanilla producer × post	0.613***	0.445***	-0.0350	0.327***	0.159	0.0383
	(0.121)	(0.113)	(0.214)	(0.0984)	(0.200)	(0.0442)
N	1620	2520	2520	2520	2520	2520
R-Squared	0.005	0.022	0.000	0.008	-0.002	-0.003
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Data used is the DEMTREND cohort panel. The dependent variables are indicators for the ownership of each individual durable asset. Household fixed effects are used in each specification. "Vanilla producer" indicates that household produced vanilla during wave 3 of the household survey in 2019. "Post" takes value one for the 2019 wave. Wave FEs include dummies for years 2003, 2012 and 2019. Data on mobile phones (col 1) are only available for waves 2 and 3. Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A9 – Specific assets in vanilla-producing regions

(a) MIS-MICS sample

	(1) Mobile Phone	(2) Motorcycle	(3) Car	(4) Radio	(5) Bicycle	(6) Watch	(7) Bank Account	(8) Finished Roof
Vanilla commune × post	0.163***	0.0708***	0.00590	0.0914**	-0.0246	0.120***	0.000282	0.0995***
	(0.0387)	(0.0253)	(0.00574)	(0.0422)	(0.0239)	(0.0384)	(0.0140)	(0.0292)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	32380	32271	32268	32269	32269	32377	32464	32271

(b) Afrobarometer sample

	(1) Mobile Phone†	(2) Car or Motorcycle	(3) Radio	(4) Television
Vanilla commune × post	0.155	-0.0347	0.294***	0.0858
	(0.103)	(0.0318)	(0.106)	(0.0708)
District × vanilla FEs	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes
N	1859	3694	3716	3697

Notes: Panel (a) displays results using the MIS & MICS 4-wave repeated cross section, while panel (b) uses the Afrobarometer survey; rural samples only. The dependent variables are indicators for whether the household (or a member of the household) owns that particular asset. †Data on mobile phone ownership in the Afrobarometer survey is only available for the final 2 rounds (in 2015 and 2018). Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A10 – Questions in the emotional stability score: DEMTREND panel

1	I am often worried
2	I am not often worried
3	I don't like myself
4	I am often sad
5	I know how to take up challenges
6	I have a bad feeling about what is going to happen
7	I panic easily
8	I see difficulties everywhere
9	I get frustrated quickly
10	I have trouble expressing my feelings
11	I am a difficult person to understand
12	I give up easily
13	I get discouraged easily
14	I sometimes feel dishonest
15	I am easily intimidated
16	It's often difficult for me to have fun
17	I exaggerate my troubles
18	I am afraid that the worst will happen
19	I am consumed by my own problems

Notes: The list of (English translations of) individual questions from the DEMTREND cohort panel used in the measures of psychological well-being in Table 5. The respondent gave numerical responses (from 1 to 5) to these 19 questions related to "emotional stability" embedded in a non-cognitive (Big Five) questionnaire containing a total of 92 questions. In Table 5 higher values indicate higher levels of "emotional stability" or, equivalently, lower levels of "neuroticism". Therefore, negative statements (questions on all rows except 2 and 5) were coded in reverse order so that a high number indicated higher "emotional stability" for each individual question.

Table A11 – Labor outcomes of vanilla producers

	Currently working	Worked in last 7 days	Worked in last 12 mos	Hours worked (main activity)	Agriculture occupation	Hours worked in agriculture	Unpaid minutes worked per day
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Full Sample							
Vanilla producer × post	-0.0601	-0.210	-0.0571	171.3	0.162***	656.0***	-54.89***
	(0.0721)	(0.130)	(0.0832)	(205.5)	(0.0529)	(169.6)	(20.46)
N	2558	2640	2488	2680	1902	2664	2546
R-Squared	0.581	0.580	0.573	0.565	0.748	0.661	0.588
Panel B. Vanilla Communes							
Vanilla producer × post	-0.0879	-0.157	-0.0730	-31.82	0.0907	468.8**	-56.32*
	(0.0715)	(0.129)	(0.0808)	(215.2)	(0.0590)	(183.5)	(31.60)
N	542	554	544	562	422	558	548
R-Squared	0.616	0.559	0.561	0.621	0.777	0.652	0.558
Panel C. Restrict to agricultural households							
Vanilla producer × post	-0.00424	-0.153	-0.00278	269.1	0.184***	678.6***	-56.06**
	(0.0725)	(0.130)	(0.0833)	(206.8)	(0.0545)	(172.3)	(21.95)
N	2006	2072	1960	2104	1642	2090	1984
R-Squared	0.564	0.566	0.564	0.548	0.679	0.617	0.587
Panel D. IV, restrict to agricultural households							
Vanilla producer × post	0.00460	-0.254	-0.0643	760.6**	0.117	1089.7***	-155.4***
	(0.113)	(0.215)	(0.130)	(328.2)	(0.124)	(228.5)	(49.06)
N	1564	1606	1532	1630	1286	1618	1546
R-Squared	-0.000	0.003	-0.002	-0.008	0.006	0.016	-0.007
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Data used is the DEMTREND cohort panel. The dependent variable is: an indicator variable related to the cohort member's current work status (columns 1-3); total hours spent in employment in the last 12 months (col 4); an indicator for whether the main occupation is agriculture (col 5); total hours spent working in agriculture in the last 12 months (col 6); total minutes per day spent doing certain categories of unpaid household work (col 7). Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A12 – Child fever and household bednets in vanilla-producing regions

	Child Fever and Medical Care			Slept under bednet		Number of bednets	
	(1) Past 2 weeks	(2) Symptoms and care	(3) Care	(4) Children	(5) Pregnant Women	(6) per 2 people	(7) per person
Vanilla commune × post	-0.0386	0.0150	-0.0101	-0.0595*	-0.0863*	-0.0769	-0.149***
	(0.0232)	(0.0618)	(0.00972)	(0.0339)	(0.0451)	(0.0653)	(0.0400)
Region × vanilla FEs	Yes	Yes	Yes	No	No	No	No
District × vanilla FEs	No	No	No	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	24592	3779	24592	23653	2680	31107	31107

Notes: Data used is the MIS & MICS 4-wave repeated cross section; rural sample only. The dependent variables are whether the child under 5 years of age had fever in the last 2 weeks, and whether the child had had any symptoms and been treated, and conditional on fever, whether the child received medical care for fever. The dependent variables also include whether the children and pregnant women of the household slept under a bednet the previous night, and the number of bednets per 2 people, and the number of bednets per person in the household. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. "Post" takes value one for the fourth round of the data 2018. Wave FEs include dummies for years 2011, 2013 and 2018. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A13 – Cross-sectional results: Adult investment in children in vanilla-producing regions

	(1)	(2)	(3)
Children under 5 years of age			
1. Exclusively breastfed during first 6 months (0-23 mo)	0.0468*	0.0272	0.0536**
	(0.0245)	(0.0212)	(0.0239)
2. Predominantly breastfed during first 6 months (0-23 mo)	0.0565**	0.0300	0.0641**
	(0.0266)	(0.0219)	(0.0274)
3. Early stimulation and responsive care (24-59 mo)	0.122***	0.113***	0.101**
	(0.0377)	(0.0362)	(0.0407)
4. Preprimary education (36-59 mo)	0.0269	0.0225	-0.00329
	(0.0380)	(0.0362)	(0.0272)
5. Inadequate supervision (under 5 yrs)	-0.0175	-0.00727	-0.0105
	(0.0278)	(0.0267)	(0.0279)
6. Physical punishment (1-4 yrs)	-0.00606	-0.00729	-0.0110
	(0.0250)	(0.0246)	(0.0332)
7. Psychological aggression (1-4 yrs)	-0.0485**	-0.0446*	-0.0401
	(0.0243)	(0.0237)	(0.0299)
Children ages 5-14			
8. Physical punishment (5-14 yrs)	0.0184	0.0202	0.0165
	(0.0329)	(0.0325)	(0.0341)
9. Psychological aggression (5-14 yrs)	-0.0197	-0.0140	-0.0141
	(0.0219)	(0.0216)	(0.0240)
10. Child reads or is read to at home (7-14 yrs)	0.0940***	0.0856**	0.0976**
	(0.0349)	(0.0332)	(0.0387)
11. Child receives help with homework (7-14 yrs)	-0.00873	0.0174	0.0233
	(0.0537)	(0.0507)	(0.0550)
12. Caretaker received report card (7-14 yrs)	0.00177	0.0107	0.00401
	(0.0434)	(0.0401)	(0.0375)
13. Caretaker attended any school meeting or event (7-14 yrs)	-0.0518	-0.0445	-0.0304
	(0.0430)	(0.0428)	(0.0508)
Individual & HH controls		Y	Y
Mother-level controls			Y

Notes: Data used is the MICS 2018 rural sample. Each cell of the table corresponds to a separate regression and contains the estimated coefficient for the "Vanilla commune" variable (an indicator for whether vanilla was reported as one of the top 5 crops in the commune census). The dependent variable is reported in each row. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the commune level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A14 – Adult investment in children (cont.): # of observations for specifications in previous table

	(1)	(2)	(3)
Children under 5 years of age			
1. Exclusively breastfed during first 6 months (0-23 mo)	3872	3858	2732
2. Predominantly breastfed during first 6 months (0-23 mo)	3872	3858	2732
3. Early stimulation and responsive care (24-59 mo)	5646	5624	4105
4. Preprimary education (36-59 mo)	3801	3786	2752
5. Inadequate supervision (under 5 yrs)	9550	9514	6865
6. Physical punishment (1-4 yrs)	7604	7575	5529
7. Psychological aggression (1-4 yrs)	7606	7577	5531
Children ages 5-14			
8. Physical punishment (5-14 yrs)	7230	7199	5362
9. Psychological aggression (5-14 yrs)	7230	7199	5362
10. Child reads or is read to at home (7-14 yrs)	4717	4696	3384
11. Child receives help with homework (7-14 yrs)	2276	2266	1669
12. Caretaker received report card (7-14 yrs)	3526	3511	2591
13. Caretaker attended any school meeting or event (7-14 yrs)	3526	3511	2591
Individual & HH controls		Y	Y
Mother-level controls			Y

Notes: Data used is the MICS 2018 rural sample. Each row refers back to the previous table and displays the number of observations in each regression.

Table A15 – Cross-sectional outcomes for children and adults in vanilla-producing regions

	Children		Adults
	(1) Under 5	(2) 5-17	(3) 18+
Functional difficulties		-0.0177	-0.0556***
		(0.0125)	(0.0179)
Child development (36-59 mo)	0.0145		
	(0.0382)		
Math skills (7-14 yrs)		0.00312	
		(0.0224)	
Reading skills (7-14 yrs)		-0.0251	
		(0.0255)	
Child seems anxious		0.0316	
		(0.0609)	
Child seems depressed		0.0132	
		(0.0580)	
Economic conditions in 12 mo			0.211***
			(0.0647)
Individual & HH controls	Y	Y	Y

Notes: Data used in the first six rows is the MICS 2018 rural sample; in the last row, the data used is the Afrobarometer 2018 rural sample. Each cell of the table corresponds to a separate regression and contains the estimated coefficient for the "Vanilla commune" indicator. The dependent variable is reported in each row. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the commune level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A16 – Cross-sectional results: Perceptions of economic well-being in vanilla-producing regions

	Own living conditions		Current economic conditions		Econ conditions now vs months ago		Econ conditions In 12 months	
	(1) post	(2) pre	(3) post	(4) pre	(5) post	(6) pre	(7) post	(8) pre
Vanilla commune	0.312***	-0.000943	0.430***	-0.00213	0.373***	-0.0239	0.211***	-0.0675
	(0.0775)	(0.0409)	(0.111)	(0.0468)	(0.0858)	(0.0481)	(0.0696)	(0.0603)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	919	2796	916	2644	913	2650	831	2256

Notes: Data used is the Afrobarometer survey; rural sample only. The table reports the results of cross-sectional specifications for the same outcomes shown in Table 4. Separate estimates are displayed for the pooled cross-section period prior to the price shock ("pre") and the final 2018 wave that follows the price shock ("post"). Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A17 – Household infrastructure in vanilla-producing regions

	Household access			Present in enumeration area	
	(1) Protected water	(2) Piped water	(3) Toilet facility	(4) Piped water	(5) Sewer
Vanilla commune × post	0.104	0.0744	-0.0213	0.134	0.00670
	(0.0740)	(0.0650)	(0.0296)	(0.220)	(0.0284)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes
Survey	MIS-MICS	MIS-MICS	MIS-MICS	Afrobarometer	Afrobarometer
Observations	32271	32271	32271	3723	3723

Notes: Data used is the MIS & MICS 4-wave repeated cross section (cols 1-3) and the Afrobarometer survey (cols 5-6); rural samples only. The dependent variables are indicators for each housing or infrastructure characteristic. In columns 1-3, we construct binary indicators as follows: "Piped water" refers to piped drinking water source (into dwelling, yard/plot, to neighbor, public tab or standpipe); "Protected water" refers to household drinking water source being either piped water (as defined), or protected well or protected spring; "Toilet facility" refers to flush toilets, pit latrines and composting toilets. In columns 5 and 6, the question refers to whether the service is available in the enumeration area. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A18 – Lack of basic necessities in vanilla-producing regions

	In past year, anyone often gone without				
	(1) Enough food to eat	(2) Enough clean water	(3) Medical treatment	(4) Fuel for cooking	(5) Cash income
Vanilla commune × post	0.152	-0.0266	0.0780	-0.0176	-0.0701
	(0.112)	(0.134)	(0.0883)	(0.0837)	(0.0792)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes
Observations	3721	3718	3713	3719	3719

Notes: Data used is the Afrobarometer survey; rural sample only. The respondent is asked, "Over the past year, how often, if ever, have you or anyone in your family gone without" each of the indicated necessities. The dependent variable is equal to 1 if the response is *several times*, *many times*, or *always*, and equal to 0 if *never* or *just once or twice*. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A19 – Wealth and assets in vanilla-producing regions: excluding areas affected by cyclone

	(1) Wealth index	(2) Mobile Phone	(3) Motorcycle	(4) Car	(5) Radio	(6) Bicycle	(7) Watch	(8) Bank Account	(9) Finished Roof
Vanilla commune × post	0.261***	0.160***	0.0631***	0.00313	0.0847*	-0.0271	0.0912**	0.00829	0.0745**
	(0.0666)	(0.0471)	(0.0235)	(0.00375)	(0.0432)	(0.0286)	(0.0425)	(0.0145)	(0.0297)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No	No	No	No
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	31991	31909	31803	31800	31801	31801	31906	31990	31803

Notes: Data used is the MIS & MICS 4-wave repeated cross section; rural sample only. Clusters that were on the path of the Enawo cyclone are removed from each survey round of the data used. The dependent variable is the wealth index (in column 1) or an indicator for whether the household (or a member of the household) owns that particular asset. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. "Post" takes value one for the fourth round of the data 2018. Wave FEs include dummies for years 2011, 2013 and 2018. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A20 – Wealth of vanilla producers: new household formation

	(1)	(2)	(3)	(4)	(5)
Panel A. Full Sample					
Vanilla producer × post	0.451***	0.509***	0.508***		
	(0.167)	(0.175)	(0.175)		
New household			0.0126		
			(0.0631)		
Same household × producer × post				0.436***	0.739**
				(0.160)	(0.324)
New household × producer × post				0.595**	0.434***
				(0.241)	(0.149)
N	4099	2438	2438	2436	2438
R-Squared	0.620	0.756	0.756	0.756	0.757
Panel B. Vanilla Communes					
Vanilla producer × post	0.538***	0.482***	0.505***		
	(0.168)	(0.172)	(0.169)		
New household			-0.153		
			(0.0971)		
Same household × producer × post				0.466***	0.708**
				(0.167)	(0.312)
New household × producer × post				0.522**	0.417**
				(0.231)	(0.174)
N	872	548	548	548	548
R-Squared	0.620	0.745	0.746	0.745	0.748
Panel C. Restrict to agricultural households					
Vanilla producer × post	0.446***	0.464***	0.463**		
	(0.168)	(0.175)	(0.176)		
New household			0.0276		
			(0.0709)		
Same household × producer × post				0.393**	0.692**
				(0.160)	(0.328)
New household × producer × post				0.553**	0.390***
				(0.241)	(0.147)
N	3179	1930	1930	1930	1930
R-Squared	0.579	0.726	0.726	0.727	0.728
Wave FE	Yes	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	Yes	Yes
Survey waves	All	2-3	2-3	2-3	2-3
New household year				2012	2019

(see notes on next page)

Notes: Data used is the DEMTREND cohort panel. The dependent variable is the household asset index, standardized by the mean and standard deviation of all non-vanilla producing households. Column 1 repeats the baseline estimate from our main results. In columns 2-5, we restrict the analysis to waves 2 and 3. In column 3, we control for a time-varying "New household" indicator that takes value 1 if the cohort member has moved out of their original household from 2003. In columns 4 and 5, we interact the producer variable with *time-invariant* indicators of household formation: in column 4, "new household" takes value 1 for individuals who change households between 2003 and 2012; while in column 5, "new household" takes value 1 for individuals who change households between 2012 and 2019. Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A21 – Wealth in vanilla-producing regions: using vanilla price

	Full sample		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
Vanilla commune × price	0.000483*	0.000680***	0.000430**	0.000518**	0.00113	0.00107
	(0.000279)	(0.000202)	(0.000212)	(0.000205)	(0.000899)	(0.000746)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes
N	43040	43040	32465	32465	10575	10575

Notes: Data used is the MIS & MICS 4-wave repeated cross section. Vanilla price (in hundreds of USD) for each survey year is interacted with the vanilla commune indicator. The data for price is obtained from COMTRADE database and is as displayed in Figure 2. The dependent variable is the wealth index. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. Wave FEs include dummies for years 2011, 2013 and 2018. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A22 – Wealth in vanilla-producing regions: 2013 as the reference year

	Full sample		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
Vanilla commune × 2018	0.207**	0.304***	0.213**	0.251***	0.360	0.343
	(0.0918)	(0.0621)	(0.0831)	(0.0674)	(0.432)	(0.359)
Vanilla commune × 2016	-0.292**	-0.0950	-0.155	-0.0740	-0.175	-0.0687
	(0.126)	(0.0988)	(0.106)	(0.0941)	(0.666)	(0.535)
Vanilla commune × 2011	-0.0686	0.0257	-0.00170	0.0316	-0.0581	-0.0514
	(0.0991)	(0.0833)	(0.0817)	(0.0709)	(0.387)	(0.310)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes
N	43040	43040	32465	32465	10575	10575

Notes: Data used is the MIS & MICS 4-wave repeated cross section. The dependent variables is the wealth index. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. Wave FEs include dummies for years 2011, 2016 and 2018, such that the 2013 round is used as the reference period. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A23 – Wealth in vanilla-producing regions: exclude 2016 data

	Full sample		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A.Post-dummy						
Vanilla commune × post	0.235**	0.279***	0.204***	0.220***	0.377	0.355
	(0.0911)	(0.0663)	(0.0740)	(0.0703)	(0.326)	(0.272)
Panel B. Year dummies						
Vanilla commune × 2018	0.191**	0.279***	0.199**	0.233***	0.349	0.337
	(0.0891)	(0.0644)	(0.0857)	(0.0703)	(0.426)	(0.357)
Vanilla commune × 2011	-0.0893	0.000460	-0.00890	0.0255	-0.0680	-0.0433
	(0.103)	(0.0850)	(0.0814)	(0.0711)	(0.357)	(0.293)
District × vanilla FEs	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32416	32416	23824	23824	8592	8592

Notes: Data used is the MIS & MICS repeated cross section with the 2016 round dropped. The dependent variable is the wealth index. "Vanilla commune" indicates that vanilla was reported as one of the top 5 crops in the commune census. "Post" takes value one for the fourth round of the data 2018. Wave FEs include dummies for years 2011, and 2018, such that 2013 round is used as the reference period. Population weights are used in each regression. Robust standard errors in parentheses, adjusted for clustering at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A24 – Outcomes of vanilla producers: adjusted for attrition

(a) Wealth and financial outcomes

	(1) Wealth	(2) Formal savings	(3) Informal savings	(4) Loans	(5) Received remittances	(6) Sent remittances
Vanilla producer × post	0.447***	-0.0382	0.375***	-0.0681	-0.0972**	-0.0329
	(0.164)	(0.138)	(0.0748)	(0.0927)	(0.0373)	(0.0446)
Household FEs	Yes	Yes	Yes	Yes	Yes	Yes
Wave FEs	Yes	Yes	Yes	Yes	Yes	Yes
N	4099	4224	4224	4224	4224	2640

(b) Psychological well-being and cognitive test scores

	Emotional Stability		Cognitive Tests	
	(1) Average	(2) Factor	(3) French	(4) Math
Vanilla producer × post	0.208**	0.376*	0.0193	0.0691***
	(0.104)	(0.207)	(0.0331)	(0.0252)
Wave FE	Yes	Yes	Yes	Yes
Household FEs	Yes	Yes	Yes	Yes
N	2366	2366	2386	2386

Notes: Data used is the DEMTREND cohort panel, full sample (corresponding to Panel A in Tables 1, 3, and 5). "Vanilla producer" indicates that household produced vanilla during wave 3 of the household survey in 2019. "Post" takes value one for the 2019 wave. Wave FEs include dummies for years 2003, 2012 and 2019. The variables considered for the Inverse Probability Weighting are: sex and age of the cohort member, household size, a dummy for household electricity access, a dummy for toilet, mother's education level and father's education level measured in wave 1. Results are displayed for the full sample. Robust standard errors in parentheses, adjusted for clustering at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.